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Description

The invention relates to new hydroterphenyls of the formula I



wherein

- 5 R^1 is alkyl,
 R^2 is H, OH, CN, alkyl,
-O-alkyl, -COOR³ or -O-CO-R³,
 R^3 is H, alkyl, -Cy-alkyl, -Ph-alkyl, -Ph-O-alkyl, -Ph-CN or
-Ph-F,
10 Cy is 1,4-cyclohexylene and
Ph is 1,4-phenylene,
and the alkyl groups each contain 1 - 10 C atoms.

- These substances can be used like similar compounds for example those known from German Offenlegungsschrift
15 2,933,563, as components of liquid crystal dielectrics, in particular for displays based on the principle of the twisted cell.

- European Offenlegungsschrift 0,019,665 relates to liquid crystal compounds which allow a variation of the
20 $\epsilon_{\perp}$ values above 5 and thus have a substantially improved adaptation to the operating requirements of LC cells by a greater freedom for varying the $\Delta\epsilon$ values, this problem being solved by the introduction of lateral substituents (X^2 to X^4) into the compounds described. The
25 resulting transverse polarization perpendicular to the axis of the molecule makes $\epsilon_{\perp}$ values above 5 possible.

- European Offenlegungsschrift 0,019,665 describes a very broad general formula which includes some of the compounds of the formula I (that is to say those where R^2
30 is halogen). However, at no point in this European Offenlegungsschrift is there a statement from which the preparation and use of these particular compounds without

lateral substitution is obvious. Accordingly, the compounds of the formula I also do not show any $\epsilon_{\perp}$ values above 5 and relate to a completely different part field of liquid crystal compounds.

5 The invention was based on the object of discovering new stable liquid crystal compounds which are suitable as components of liquid crystal dielectrics, especially for nematic phases with a broad nematic range and low viscosity. This object was achieved by providing the compounds of the formula I.

10 It has been found that the compounds of the formula I are outstandingly suitable as components of liquid crystal dielectrics. In particular, stable liquid crystal phases with a broad nematic range and a low viscosity can be prepared with the aid of these
15 compounds.

In addition, by providing the compounds of the formula I, the range of liquid crystal substances which, from various technological viewpoints, are suitable for the preparation of nematic mixtures is quite generally
20 considerably extended.

The compounds of the formula I have a broad field of application. Depending of the choice of substituents, these compounds can be used as base materials of which liquid crystal dielectrics are predominantly composed; however, compounds of the formula I can also be
25 added to liquid crystal base materials of other classes of compound, for example in order to reduce the viscosity of such a dielectric. The compounds of the formula I, especially those wherein R^2 is H, OH, CN or
30 COOH, are furthermore suitable as intermediates for the preparation of other substances which can be used as constituents of liquid crystal dielectrics.

The compounds of the formula I are colourless in the pure state, and form liquid crystal mesophases in a
35 temperature range favourable for electrooptical use. Chemically, they are very stable.

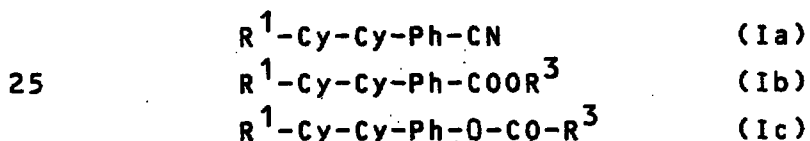
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The invention thus relates to the compounds of the formula I and a process for their preparation, characterized in that a compound which corresponds to the formula I but contains (a) reducible group(s) and/or additional C-C bonds instead of hydrogen atoms, is
5 treated with a reducing agent, and in that, where relevant, the radical R^2 in a resulting compound of the formula I is converted into another radical R^2 .

The invention furthermore relates to the use of
10 the compounds of the formula I as components of liquid crystal dielectrics. The invention moreover relates to liquid crystal dielectrics containing at least one compound of the formula I, and to electrooptical display elements which contain such dielectrics.

15 In the preceding and following text, R^1 , R^2 , R^3 , Cy and Ph have the meanings given, unless expressly indicated otherwise.

The compounds of the formula I include, for example, the preferred compounds of the formula I',
20 which corresponds to the formula I but in which the radical R^2 is CN, $-\text{COOR}^3-\text{O}-\text{CO}-\text{R}^3$, or OH, in particular, the preferred nitriles of the formula Ia and the preferred esters of the formulae Ib and Ic:



Furthermore, the hydroterphenyl derivatives of the formula Ie, which are important, above all, as intermediates, are preferred:



In the compounds of the formulae I and Ia to Ie, those stereoisomers wherein the substituents on the two 1,4-cyclohexylene radicals are in each case in the trans-position relative to one another, are preferred.

35 In the compounds of the formula I, the alkyl or O-alkyl radicals can be straight-chain or branched.

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Preferably, they are straight-chain, have 2, 3, 4, 5 or 6 C atoms and accordingly are preferably ethyl, propyl, butyl, pentyl, hexyl, ethoxy, propoxy, butoxy, pentoxy or hexoxy, and furthermore methyl, heptyl, octyl, nonyl, decyl, methoxy, heptoxy, octoxy, nonoxy or decoxy. Compounds of the formulae I and Ia to Ie with branched end groups R^1 or R^2 can occasionally be of importance because they have a better solubility in the customary liquid crystal base materials, but especially as chiral doping substances, if they are optically active. Branched groups of this type as a rule contain not more than one chain-branching. Preferred branched radicals R^1 and R^2 are isopropyl, 2-butyl (= 1-methylpropyl), isobutyl (= 2-methylpropyl), 2-methyl-butyl, isopentyl (= 3-methyl-butyl), 2-methylpentyl, 3-methylpentyl, 2-ethylhexyl, 2-heptyl (= 1-methylhexyl), 2-octyl (= 1-methylheptyl), 2-ethylpentyl, isopropoxy, 2-methylpropoxy, 2-methyl-butoxy, 3-methylbutoxy, 2-methylpentoxy, 3-methylpentoxy, 2-ethylhexoxy, 1-methylhexoxy and 1-methylheptoxy.

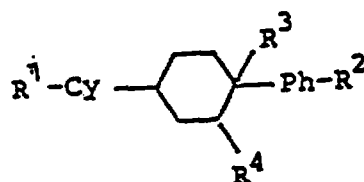
The compounds of the formula I are prepared by methods which are known per se, such as are described in the literature (for example in the standard works, such as Houben-Weyl, Methoden der Organischen Chemie [Methods of Organic Chemistry], Georg-Thieme Verlag, Stuttgart), and in particular under reaction conditions which are known and suitable for the reactions mentioned. It is also possible to utilize variants which are known per se and are not mentioned here in more detail.

If desired, the starting substances can also be formed in situ, in a manner such that they are not isolated from the reaction mixture but are immediately reacted further to give the compounds of the formula I.

The compounds of the formula I are preferably prepared by reducing a compound of the formula II

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(II)

wherein either R^3 is OH and R^4 is H, or R^3 and R^4 together are a C-C bond.

The carbinols of the formula II (R^3 is OH, R^4 is H) can be obtained, for example, by hydrogenation of cyclohexylphenols of the formula R^1 -Cy-Ph-OH to give cyclohexylcyclohexanols of the formula R^1 -Cy-Cy-OH, oxidation to give the corresponding 4- R^1 -Cy-cyclohexanones, reaction with a Grignard compound of the formula $BrMg$ -Ph- R^2 and hydrolysis. The cyclohexenes of the formula II (R^3 and R^4 together are a C-C bond) can be prepared therefrom by splitting off water, for example with a strong acid, such as sulfuric acid or p-toluenesulfonic acid, in an inert solvent, such as benzene or toluene.

The starting substances of the formula II are preferably reduced to the compounds of the formula I by catalytic hydrogenation at temperatures between about 0° and about 200° and under pressures between about 1 and about 200 bar in an inert solvent, for example an alcohol, such as methanol, ethanol or isopropanol, an ether, such as tetrahydrofuran (THF) or dioxane, an ester, such as ethyl acetate, a carboxylic acid, such as acetic acid, or a hydrocarbon, such as cyclohexane.

Preferred suitable catalysts are noble metals, such as Pt or Pd, which can be used in the form of oxides (for example PtO_2 or PdO), on a support (for example Pd on charcoal, calcium carbonate or strontium carbonate) or in finely divided form (for example Pt-black).

After the reduction stage, it may be preferable to convert the resulting stereoisomer mixture into the

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stable trans-isomer (in relation to the cyclohexane ring obtained by hydrogenation), for example by treatment with a base, such as K-tert.-butylate, in an inert solvent, such as dimethylformamide (DMF), N-methylpyrrolidone or dimethylsulfoxide, at temperatures between
5 about 0 and about 150°.

If desired, the radical R^2 in a resulting compound of the formula I can be converted into another radical R^2 .

Thus, chlorination or bromination of the hydro-
10 terphenyls of the formula I, R^2 is H, leads to chlorine or bromine compounds of the formula I (R^2 is Cl or Br), for example using elementary chlorine or bromine in an inert solvent, such as diethyl ether, CCl_4 or acetic acid, at temperatures between about -30 and 100°, it
15 being possible for catalysts, such as iron filings, iodine or $AlCl_3$, to be present.

Nitriles of the formula Ia can be obtained by reacting these chlorine or bromine compounds with $Cu_2(CN)_2$, for example in the presence of pyridine in
20 an inert solvent, such as DMF or N-methylpyrrolidone, at temperatures between 40 and 200°.

Furthermore, hydroterphenyls of the formula I, where R^2 is H, can be converted into ketones of the formula $R^1-Cy-Cy-Ph-CO-R^5$ by acylation with carboxylic acids of
25 the formula $HOOC-R^5$ (wherein R^5 is alkyl with 1 - 9 C atoms) or their reactive derivatives, preferably in the presence of an acid catalyst and of an inert solvent at temperatures between about 0° and about 120°. Suit-
15 able derivatives of the carboxylic acids are, above all, their anhydrides and halides, for example the corresponding acid chlorides and acid bromides. Suitable catalysts are acids, such as HF, H_3PO_4 or polyphosphoric acid or, preferably, Lewis acids, such as $AlCl_3$, $AlBr_3$,
20 $SnCl_4$, $ZnCl_2$, $FeCl_3$, $SbCl_5$ or BF_3 or its etherate, and examples of suitable solvents are CS_2 , hydrocarbons, such as hexane, halogenated hydrocarbons, such as

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methylene chloride, nitrobenzene or tetramethylenesulphone.

The ketones mentioned can be oxidized to carboxylic acids of the formula I (R^2 is COOH), for example with hypohalite, preferably produced in situ from bromine and a base, such as NaOH, in aqueous dioxane at temperatures between about 0 and about 50°.

The carboxylic acids of the formula I (R^2 is COOH) can be converted into the corresponding acid chlorides in the customary manner, for example with $SOCl_2$ or PCl_5 at temperatures between about 0 and 100°, and these acid chlorides can be converted into the corresponding acid amides of the formula $R^1-Cy-Cy-Ph-CONH_2$ with ammonia, for example in aqueous dioxane at temperatures between about 0 and 30°.

Dehydration of these amides leads to the nitriles of the formula Ia. Examples of suitable agents which split off water are inorganic acid chlorides, such as $SOCl_2$, PCl_3 , $POCl_3$, PCl_5 , SO_2Cl_2 and $COCl_2$, and furthermore P_2O_5 , P_2S_5 , $AlCl_3$ (for example as a double compound with NaCl) and aromatic sulfonic acids and sulfonic acid halides. This process can be carried out in the presence or absence of an inert solvent at temperatures between about 20 and 150°; examples of possible solvents are aromatic hydrocarbons, such as benzene, toluene or xylene, and amides, such as DMF.

Compounds of the formula I, where R^2 is alkyl, can be obtained, for example, by reduction of the ketones mentioned of the formula $R^1-Cy-Cy-Ph-CO-R^5$ by the methods of Clemmensen (with zinc, amalgamated zinc or tin and hydrochloric acid, preferably in aqueous-alcoholic solution or in a heterogeneous phase system with water/ benzene or water/toluene at temperatures between about 80 and 120°) or Wolff-Kishner (with hydrazine, preferably in the presence of alkali, such as KOH or NaOH, in a high-boiling solvent, such as diethylene glycol or triethylene glycol, at tempera-

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tures between about 100 and 200°). The ketones can also be hydrogenated catalytically under the abovementioned conditions to give the hydrocarbons of the formula I, where R^2 is alkyl, preferably over a Pt or Pd catalyst at temperatures between 20 and 80° and under normal pressure in one of the solvents mentioned, for example THF.

Reaction of the ketones mentioned with hydroxylamine, for example in aqueous ethanol in the presence of a base, such as KOH or pyridine, at temperatures between about 20 and 100°, gives the corresponding oximes, which can be converted into the corresponding amides of the formula R^1 -Cy-Cy-Ph-NH-CO- R^5 under the conditions of a Beckmann rearrangement, for example with PCl_5 or formic acid at temperatures between about 20 and 100°. Hydrolysis, for example with aqueous mineral acids, such as sulphuric acid or hydrochloric acid, at temperatures between about 20 and 150° leads to the corresponding amines of the formula R^1 -Cy-Cy-Ph-NH₂. These can also be prepared by nitration of the hydrocarbons of the formula I, where R^2 is H, and subsequent reduction of the resulting nitro compounds of the formula R^1 -Cy-Cy-Ph-NO₂, for example by hydrogenation under the abovementioned conditions, or by a chemical route, for example with nascent hydrogen, which can be produced with the systems Fe/HCl, Zn/NaOH, Zn/CH₃COOH or Sn/HCl, or with SnCl₂/HCl, with H₂S or sulfides or with Na₂S₂O₄.

Phenols of the formula Ie can be obtained, for example, by diazotisation of the amines and subsequent boiling. The diazotisation can be carried out in the customary manner with a salt or an ester of nitrous acid (such as NaNO₂ or butyl nitrite) in an acid aqueous medium, and the resulting diazonium salt solution can then be decomposed by hydrolysis at temperatures between about 50 and 150°.

Alkoxy compounds of the formula I (R^2 = O-alkyl)

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can be obtained by alkylation of the phenols of the formula Ia, the phenol preferably first being converted into a phenolate, for example into the corresponding alkali metal phenolate by treatment with NaOH, KOH, Na₂CO₃ or K₂CO₃. This phenolate can then be reacted with the corresponding alkyl halide or sulfonate or dialkyl-sulfate, preferably in an inert solvent, such as acetone, DMF or dimethylsulfoxide or an excess of aqueous or aqueous-alcoholic NaOH or KOH, at temperatures between about 20 and 100°.

Esters of the formulae Ib (wherein R³ is other than H) and Ic can also be obtained by esterification of carboxylic acids of the formula I (R² is COOH) (or their reactive derivatives) with alcohols or phenols of the formula HO-R³ (or their reactive derivatives) or of phenols of the formula Ia (or their reactive derivatives) with carboxylic acids of the formula HOOC-R³ (or their reactive derivatives).

Particularly suitable reactive derivatives of the carboxylic acids mentioned are the acid halides, above all the chlorides and bromides, and furthermore the anhydrides, for example also mixed anhydrides of the formulae R¹-Cy-Cy-CO-O-COCH₃ and R³-CO-O-COCH₃, azides and esters, in particular alkyl esters with 1 - 4 C atoms in the alkyl group.

Possible reactive derivatives of the alcohols and phenols mentioned are, in particular, the corresponding metal alcoholates or phenolates of the formulae MO-R³ and R¹-Cy-Cy-Ph-Ph-OM in which M is one equivalent of a metal, preferably an alkali metal, such as Na or K.

The esterification is advantageously carried out in the presence of an inert solvent. Particularly suitable solvents are ethers, such as diethyl ether, di-n-butyl ether, THF, dioxane or anisole, ketones, such as acetone, butanone or cyclohexanone, amides, such as DMF or hexamethylphosphoric triamide, hydrocarbons, such as

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benzene, toluene or xylene, halohydrocarbons, such as carbon tetrachloride or tetrachloroethylene, and sulf-oxides, such as dimethylsulfoxide or sulfolane. Water-immiscible solvents can at the same time advantageously be used for azeotropic distillation of the water formed during the esterification. An excess of an organic base, for example pyridine, quinoline or triethylamine, may occasionally also be used as a solvent for the esterification. The esterification can also be carried out in the absence of a solvent, for example by simply heating the components in the presence of sodium acetate. The reaction temperature is usually between -50° and $+250^{\circ}$, preferably between -20° and $+80^{\circ}$. At these temperatures, the esterification reactions have as a rule ended after 15 minutes to 48 hours.

Specifically, the reaction conditions for the esterification depend largely on the nature of the starting substances used. Thus, a free carboxylic acid is as a rule reacted with a free alcohol or phenol in the presence of a strong acid, for example a mineral acid, such as hydrochloric acid or sulfuric acid. A preferred reaction procedure is to react an acid anhydride or, in particular, an acid chloride with an alcohol, preferably in a basic medium, particularly important bases being alkali metal hydroxides, such as sodium hydroxide or potassium hydroxide, alkali metal carbonates or bicarbonates, such as sodium carbonate, sodium bicarbonate, potassium carbonate or potassium bicarbonate, alkali metal acetates, such as sodium acetate or potassium acetate, alkaline earth metal hydroxides, such as calcium hydroxide, or organic bases, such as triethylamine, pyridine, lutidine, collidine, or quinoline. A further preferred embodiment of the esterification comprises first converting the alcohol or phenol into the sodium or potassium alcoholate or phenolate, for example by treatment with ethanolic sodium hydroxide solution or

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potassium hydroxide solution, isolating this alcoholate or phenolate and suspending it in acetone or diethyl ether, together with sodium bicarbonate or potassium carbonate, while stirring, and adding a solution of the acid chloride or anhydride in diethyl ether, acetone or DMF to this suspension, preferably at temperatures between about -25 and +20°.

The dielectrics according to the invention consist of 2 to 15, preferably 3 to 12, components, at least one of which is a compound of the formula I. The other constituents are preferably chosen from the nematic or nematogenic substances, in particular the known substances, from the classes of the azoxybenzenes, benzyldeneanilines, biphenyls, terphenyls, phenyl or cyclohexylbenzoates, phenyl or cyclohexyl cyclohexanecarboxylates, phenylcyclohexanes, cyclohexylbiphenyls, cyclohexylcyclohexanes, cyclohexyl-naphthalenes, 1,4-bis-cyclohexylbenzenes, 4,4'-bis-cyclohexylbiphenyls, phenyl- or cyclohexylpyrimidines, phenyl- or cyclohexyldioxanes, optionally halogenated stilbenes, benzyl phenyl ethers, tolanes and substituted cinnamic acids.

The most important compounds which can be used as constituents of such liquid crystal dielectrics can be characterized by the formula III



wherein A and E each is a carbocyclic or heterocyclic ring system from the group comprising 1,4-disubstituted benzene and cyclohexane rings, 4,4'-disubstituted biphenyl, phenylcyclohexane and cyclohexylcyclohexane systems, 2,5-disubstituted pyrimidine and 1,3-dioxane rings, 2,6-disubstituted naphthalene, di- and tetrahydronaphthalene, quinazoline and tetrahydroquinazoline, G is -CH=CH-, -CH=CY-, -C≡C-, -CO-O-, -CO-S-, -CH=N-, -N(O)=N-, -CH=N(O)-, -CH₂-CH₂-, -CH₂-O-, -CH₂-S-,

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-COO-Ph-COO- or a C-C single bond, Y is halogen, preferably chlorine, or -CN and R⁶ and R⁷ are alkyl, alkoxy, alkanoyloxy or alkoxycarbonyloxy with up to 18, preferably up to 8, carbon atoms, or one of these radicals can
5 also be CN, NC, NO₂, CF₃, F, Cl or Br.

In most of these compounds, R⁶ and R⁷ differ from each other, one of these radicals usually being an alkyl or alkoxy group. However, other variants of the envisaged substituents are also customary. Many such substances or
10 mixtures thereof are commercially available.

The dielectrics according to the invention contain about 0.1 to 60%, preferably 2 to 25%, of one or more compounds of the formula I.

The dielectrics according to the invention are
15 prepared in a manner which is customary per se. As a rule, the components are dissolved in one another, preferably at elevated temperature.

The liquid crystal dielectrics according to the invention can be modified, by suitable additives, such
20 that they can be used in all the types of liquid crystal display elements which have hitherto been disclosed.

Such additives are known to the expert and are described in detail in the literature. For example, conductive salts, preferably ethyl-dimethyl-dodecyl-ammonium 4-hexyloxybenzoate, tetrabutylammonium tetra-
25 phenylboronate or complex salts of crown ethers (compare, for example, I. Haller et al., Mol. Cryst. Liq. Cryst. Volume 24, pages 249 - 258 (1973)) can be added to improve the conductivity, dichroic dyestuffs can be added
30 to prepare coloured guest/host systems, or substances can be added to modify the dielectric anisotropy, the viscosity and/or the orientation of the nematic phases. Such substances are described, for example, in German Offenlegungsschriften 2,209,127, 2,240,864, 2,321,632,
35 2,338,281, 2,450,088, 2,637,430, 2,853,728 and 2,902,177.

The examples which follow are intended to

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illustrate the invention without limiting it. In the examples, m.p. is the melting point and c.p. is the clear point of a liquid crystal substance. Percentages in the preceding and following text are percentages by weight; all the temperatures are given in degrees Centi-
5 grade. "Customary working up" means: if necessary, water and/or an organic solvent, such as toluene CH_2Cl_2 (sic) or CHCl_3 is added, the phases are separated, the organic phase is evaporated and the residue is purified
10 by chromatography and/or crystallization.

Example 1

A solution of 28.2 g of 1-phenyl-4-(trans-4-propyl-cyclohexyl)-cyclohexene [obtainable by hydro-
15 generation of trans-1-p-hydroxyphenyl-4-propylcyclohexane over PtO_2 in ethyl acetate at 50° to give trans-4-(trans-4-propylcyclohexyl)-cyclohexanol, oxidation with NaOCl to give 4-(trans-4-propylcyclohexyl)-cyclohexanone,
20 reaction with $\text{C}_6\text{H}_5\text{MgBr}$ in THF and subsequent hydrolysis to give 1-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexanol and dehydration with p-toluenesulfonic acid in boiling toluene] in 350 ml of THF is hydrogenated over 3 g of PdO at 40° and under 1 bar until the uptake of hydrogen ceases. The mixture is filtered, the filtrate is evaporated, the resulting cis-trans mixture is dis-
25 solved in 140 ml of DMF, 14 g of K-tert.-butoxide are added and the mixture is heated to 100° under N_2 for 24 hours.

After the mixture has cooled, it is poured into water and the resulting trans-1-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane is filtered off. M.p.
30 74°C , c.p. 102°C .

The following compounds are obtained analogously by hydrogenation of the corresponding cyclohexenes:

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	trans-1-phenyl-4-(trans-4-methylcyclohexyl)-cyclohexane
	trans-1-phenyl-4-(trans-4-ethylcyclohexyl)-cyclohexane
5	trans-1-phenyl-4-(trans-4-butylcyclohexyl)-cyclohexane
	trans-1-phenyl-4-(trans-4-pentylcyclohexyl)-cyclohexane
10	trans-1-phenyl-4-(trans-4-hexylcyclohexyl)-cyclohexane
	trans-1-phenyl-4-(trans-4-heptylcyclohexyl)-cyclohexane
	trans-1-phenyl-4-(trans-4-octylcyclohexyl)-cyclohexane
15	trans-1-phenyl-4-(trans-4-nonylcyclohexyl)-cyclohexane
	trans-1-phenyl-4-(trans-4-decylcyclohexyl)-cyclohexane
20	trans-1-p-tolyl-4-(trans-4-ethylcyclohexyl)-cyclohexane
	trans-1-p-tolyl-4-(trans-4-propylcyclohexyl)-cyclohexane
	trans-1-p-tolyl-4-(trans-4-butylcyclohexyl)-cyclohexane
25	trans-1-p-tolyl-4-(trans-4-pentylcyclohexyl)-cyclohexane
	trans-1-p-tolyl-4-(trans-4-hexylcyclohexyl)-cyclohexane
30	trans-1-p-ethylphenyl-4-(trans-4-ethylcyclohexyl)-cyclohexane
	trans-1-p-ethylphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane, m.p. 33°C, c.p. 162°C, ν_{20} 16 mm ² /s
	trans-1-p-ethylphenyl-4-(trans-4-butylcyclohexyl)-cyclohexane
35	trans-1-p-ethylphenyl-4-(trans-4-pentylcyclohexyl)-cyclohexane

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- trans-1-p-ethylphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-propylphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 5 trans-1-p-propylphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- trans-1-p-propylphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- 10 trans-1-p-propylphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- trans-1-p-propylphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-butylphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 15 trans-1-p-butylphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- trans-1-p-butylphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- 20 trans-1-p-butylphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- trans-1-p-butylphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-pentylphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 25 trans-1-p-pentylphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- trans-1-p-pentylphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- 30 trans-1-p-pentylphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- trans-1-p-pentylphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-hexylphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 35 trans-1-p-hexylphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane

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- trans-1-p-hexylphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- trans-1-p-hexylphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- 5 trans-1-p-hexylphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-methoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 10 trans-1-p-methoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- trans-1-p-methoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- trans-1-p-methoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- 15 trans-1-p-methoxyphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-ethoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- 20 trans-1-p-ethoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- trans-1-p-ethoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- trans-1-p-ethoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- 25 trans-1-p-ethoxyphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane
- trans-1-p-propoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
- trans-1-p-propoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
- 30 trans-1-p-propoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
- trans-1-p-propoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
- 35 trans-1-p-propoxyphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane

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- trans-1-p-butoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
trans-1-p-butoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
5 trans-1-p-butoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
trans-1-p-butoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
trans-1-p-butoxyphenyl-4-(trans-4-hexylcyclohexyl)-
10 cyclohexane
trans-1-p-pentoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
trans-1-p-pentoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
15 trans-1-p-pentoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
trans-1-p-pentoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
trans-1-p-pentoxyphenyl-4-(trans-4-hexylcyclohexyl)-
20 cyclohexane
trans-1-p-hexoxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexane
trans-1-p-hexoxyphenyl-4-(trans-4-propylcyclohexyl)-
cyclohexane
25 trans-1-p-hexoxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane
trans-1-p-hexoxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexane
trans-1-p-hexoxyphenyl-4-(trans-4-hexylcyclohexyl)-
30 cyclohexane.

Example 2

- a) A mixture of 28.4 g of trans-1-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane, 13.4 g of AlCl_3 and 120 ml of CH_2Cl_2 is stirred at 20° for 24 hours and is then poured
35 into 2% hydrochloric acid. Customary working up gives p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-

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acetophenone. M.p. 81° , c.p. 115° .

b) A solution of 7 g of hydroxylammonium chloride in 115 ml of water is added to a solution of 32.6 g of p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-acetophenone in 200 ml of ethanol. After a solution of 5.6 g of KOH in 10 ml of water has been added, the mixture is boiled for 2 hours, cooled and diluted with water and the p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-acetophenone oxime which has precipitated is filtered off, washed with water and dried.

c) A mixture of 34.1 g of p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-acetophenone oxime and 170 ml of formic acid is boiled for 12 hours and evaporated. The crude residue, which consists of trans-1-p-acetamidophenyl-4-(trans-4-propylcyclohexyl)-cyclohexane is boiled with 340 ml of 20% H_2SO_4 for 3 hours in order to split off the acetyl group. After the mixture has been cooled, a solution of 7 g of $NaNO_2$ in 20 ml of water is added dropwise at 0° , while stirring, stirring is continued for 1 hour and the resulting mixture is introduced in portions, while stirring, into 300 ml of 60% H_2SO_4 , which has been warmed to 130° . The mixture is cooled and the resulting trans-1-p-hydroxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane is filtered off and recrystallized from toluene.

Analogously, via

p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-acetophenone

p-(trans-4-(trans-4-butylcyclohexyl)-cyclohexyl)-acetophenone

p-(trans-4-(trans-4-pentylcyclohexyl)-cyclohexyl)-acetophenone

p-(trans-4-(trans-4-hexylcyclohexyl)-cyclohexyl)-acetophenone

and the corresponding oximes, via

trans-1-p-acetamidophenyl-4-(trans-4-ethylcyclohexyl)-

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cyclohexane

trans-1-p-acetamidophenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane5 trans-1-p-acetamidophenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexanetrans-1-p-acetamidophenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexaneand the corresponding 1-p-aminophenyl compounds, there are
obtained10 trans-1-p-hydroxyphenyl-4-(trans-4-ethylcyclohexyl)-
cyclohexanetrans-1-p-hydroxyphenyl-4-(trans-4-butylcyclohexyl)-
cyclohexane15 trans-1-p-hydroxyphenyl-4-(trans-4-pentylcyclohexyl)-
cyclohexanetrans-1-p-hydroxyphenyl-4-(trans-4-hexylcyclohexyl)-
cyclohexane.

Example 3

A solution of 32.6 g of p-(trans-4-(trans-4-propyl-
20 cyclohexyl-cyclohexyl)-acetophenone (sic) in 320 ml of
THF is hydrogenated over 3 g of 5% Pd-on-C at 40° and
under normal pressure until the uptake of H₂ ceases. The
mixture is filtered and the filtrate is evaporated to
give trans-1-p-ethylphenyl-4-(trans-4-propylcyclohexyl)-
25 cyclohexane.

Example 4

A mixture of 32.6 g of p-(trans-4-(trans-4-
propylcyclohexyl)-cyclohexyl)-acetophenone, 15 g of KOH,
25 ml of 85% hydrazine and 250 ml of diethylene glycol
30 is warmed to 100° for 1 hour. The temperature is inc-
reased slowly until the hydrazone formed decomposes, and
is boiled for another 4 hours, cooled and worked up in
the customary manner to give trans-1-p-ethylphenyl-4-
(trans-4-propylcyclohexyl)-cyclohexane.

35 Example 5

A mixture of 36.3 g of trans-1-p-bromophenyl-4-

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(trans-4-propylcyclohexyl)-cyclohexane, 10 g of $\text{Cu}_2(\text{CN})_2$, 120 ml of pyridine and 60 ml of N-methylpyrrolidone is heated to 160° for 2 hours. The mixture is cooled, a solution of 120 g of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in 600 ml of 20% hydrochloric acid is added and the mixture is warmed to 70° for 1.5 hours, while stirring, and worked up in the customary manner to give trans-1-p-cyanophenyl-4-(trans-4-propylcyclohexyl)-cyclohexane, m.p. 55° , c.p. 184° .

The following compounds are obtained analogously from the corresponding bromine compounds:

trans-1-p-cyanophenyl-4-(trans-4-methylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-ethylcyclohexyl)-cyclohexane, m.p. 76° , c.p. 195°

trans-1-p-cyanophenyl-4-(trans-4-butylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-pentylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-hexylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-heptylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-octylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-nonylcyclohexyl)-cyclohexane

trans-1-p-cyanophenyl-4-(trans-4-decylcyclohexyl)-cyclohexane

Example 6

A solution of 32.6 g of p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-acetophenone in 100 ml of dioxane is added dropwise to a solution of 40 g of NaOH and 48 g of bromine in 230 ml of water at 20° , while stirring, stirring is continued for 1 hour, a solution of 14 g of NaHSO_3 in 140 ml of water is added and hydrochloric acid is added until the pH is 5. Customary

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working up (CH_2Cl_2) gives p-(trans-4-(trans-4-propyl-cyclohexyl)-cyclohexyl)-benzoic acid. The crude product is boiled with 60 ml of SOCl_2 for 2.5 hours. After evaporation, the resulting crude acid chloride is dissolved in 430 ml of dioxane, 200 ml of 25% aqueous ammonia are added and the mixture is poured onto ice and filtered to give p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzamide. 65 g of POCl_3 are added dropwise to a solution of 32.7 g of this amide in 500 ml of DMF at 50° , while stirring. After the mixture has been further stirred for 1 hour, it is poured onto ice and worked up in the customary manner (CH_2Cl_2) to give trans-1-p-cyanophenyl-4-(trans-4-propylcyclohexyl)-cyclohexane, m.p. 55° , c.p. 184° .

The corresponding benzamides and benzonitriles are obtained analogously via

- p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoic acid
- p-(trans-4-(trans-4-butylcyclohexyl)-cyclohexyl)-benzoic acid
- p-(trans-4-(trans-4-pentylcyclohexyl)-cyclohexyl)-benzoic acid
- p-(trans-4-(trans-4-hexylcyclohexyl)-cyclohexyl)-benzoic acid.

Example 7

A mixture of 30 g of trans-1-p-hydroxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane, 6.9 g of K_2CO_3 , 25 g of hexyl iodide and 250 ml of DMF is heated to 80° for 16 hours, while stirring, and is then cooled and worked up in the customary manner. Trans-1-p-hexoxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane is obtained.

Example 8

8 g of acetyl chloride are added to a solution of 30 g of trans-1-p-hydroxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane and 20 ml of pyridine in 300 ml of

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toluene and the mixture is warmed to 80° for 1 hour. After cooling and customary working up, trans-1-p-acetoxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane is obtained.

5 The following compounds are obtained analogously by esterification

- trans-1-p-acetoxyphe~~n~~yl-4-(trans-4-ethylcyclohexyl)-cyclohexane
- 10 trans-1-p-formyloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-propionyloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-butyryloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- 15 trans-1-p-pentanoyloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-hexanoyloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- 20 trans-1-p-decanoyloxyphenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-(trans-4-propylcyclohexylcarbonyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-(trans-4-butylcyclohexylcarbonyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- 25 trans-1-p-(trans-4-pentylcyclohexylcarbonyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-(p-ethylbenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-(p-propylbenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- 30 trans-1-p-(p-butylbenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- trans-1-p-(p-methoxybenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane
- 35 trans-1-p-(p-ethoxybenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane

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trans-1-p-(p-propoxybenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane

trans-1-p-(p-cyanobenzoyloxy)-phenyl-4-(trans-4-propylcyclohexyl)-cyclohexane.

5 Example 9

32.8 g of p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoic acid are boiled with 24 g of SOCl₂ for 1 hour, the mixture is evaporated, the resulting crude acid chloride is dissolved in 150 ml of toluene,
10 and 8 g of pyridine and 6 g of propanol are added and the mixture is boiled for 2 hours. Cooling and customary working up (CH₂Cl₂) give propyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate.

The following compounds are obtained analogously
15 by esterification:

methyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
ethyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
20 propyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
butyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
pentyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
25 hexyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
p-cyanophenyl p-(trans-4-(trans-4-ethylcyclohexyl)-cyclohexyl)-benzoate
30 methyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
ethyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
butyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
35 pentyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate

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- hexyl)-benzoate
- hexyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 5 heptyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- octyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- nonyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 10 decyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- trans-4-propylcyclohexyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- trans-4-butylcyclohexyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 15 trans-4-pentylcyclohexyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- p-tolyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 20 p-propylphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- p-butylphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- p-pentylphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 25 p-methoxyphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- p-ethoxyphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- 30 p-decyloxyphenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- p-cyanophenyl p-(trans-4-(trans-4-propylcyclohexyl)-cyclohexyl)-benzoate
- propyl p-(trans-4-(trans-4-butylcyclohexyl)-cyclohexyl)-benzoate
- 35 butyl p-(trans-4-(trans-4-butylcyclohexyl)-cyclo-

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- hexyl)-benzoate
pentyl p-(trans-4-(trans-4-butylcyclohexyl)-cyclo-
hexyl)-benzoate
p-cyanophenyl p-(trans-4-(trans-4-butylcyclohexyl)-
5 cyclohexyl)-benzoate
propyl p-(trans-4-(trans-4-pentylcyclohexyl)-cyclo-
hexyl)-benzoate
butyl p-(trans-4-(trans-4-pentylcyclohexyl)-cyclo-
hexyl)-benzoate
10 pentyl p-(trans-4-(trans-4-pentylcyclohexyl)-cyclo-
hexyl)-benzoate
p-cyanophenyl p-(trans-4-(trans-4-pentylcyclohexyl)-
cyclohexyl)-benzoate
propyl p-(trans-4-(trans-4-hexylcyclohexyl)-cyclo-
15 hexyl)-benzoate
butyl p-(trans-4-(trans-4-hexylcyclohexyl)-cyclo-
hexyl)-benzoate
pentyl p-(trans-4-(trans-4-hexylcyclohexyl)-cyclo-
hexyl)-benzoate
20 p-cyanophenyl p-(trans-4-(trans-4-hexylcyclohexyl)-
cyclohexyl)-benzoate.

The examples which follow are of dielectrics accord-
ing to the invention containing at least one compound of
the formula I:

25 Example A

- A mixture of
21% of p-(trans-4-propylcyclohexyl)-benzonitrile,
30% of p-(trans-4-pentylcyclohexyl)-benzonitrile,
22% of p-(trans-4-heptylcyclohexyl)-benzonitrile,
30 12% of trans-1-p-cyanophenyl-4-(trans-4-ethyl-
cyclohexyl)-cyclohexane and
15% of trans-1-p-cyanophenyl-4-(trans-4-propyl-
cyclohexyl)-cyclohexane

has an m.p. of -12° and a c.p. of 82° .

- 35 The mixture can be used, for example, for a "twisted
nematic display (TND)" for addressing in a "static drive"

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("direct drive") with operating voltages of 3 - 10 Volt.

Example B

- 20% of p-(trans-4-ethylcyclohexyl)-benzonitrile,
13% of 4-ethyl-4'-cyanobiphenyl,
5 22% of 4-butyl-4'-cyanobiphenyl,
9% of p-cyanophenyl p-ethylbenzoate,
6% of p-cyanophenyl p-propylbenzoate,
13% of trans-1-p-cyanophenyl-4-(trans-4-ethyl-
cyclohexyl)-cyclohexane and
10 17% of trans-1-p-cyanophenyl-4-(trans-4-propyl-
cyclohexyl)-cyclohexane

has an m.p. of -8° and a c.p. of 64° .

This mixture can be used, for example, for a TND
at low operating voltages.

15 Example C

- A mixture of
12% of p-(trans-4-propylcyclohexyl)-benzonitrile,
10% of p-(trans-4-butylcyclohexyl)-benzonitrile,
19% of p-(trans-4-pentylcyclohexyl)-benzonitrile,
20 10% of p-(trans-4-heptylcyclohexyl)-benzonitrile,
12% of 4-cyano-4'-(trans-4-pentylcyclohexyl)-bi-
phenyl,
12% of trans-1-p-cyanophenyl-4-(trans-4-ethyl-
cyclohexyl)-cyclohexane,
25 15% of trans-1-p-cyanophenyl-4-(trans-4-propyl-
cyclohexyl)-cyclohexane and
10% of trans-1-p-fluorophenyl-4-(trans-4-propyl-
cyclohexyl)-cyclohexane

has an m.p. of -13° and a c.p. of 97° .

- 30 It is suitable, for example, as a nematic solvent
for dichroic dyestuffs ("host mixture").


Claims (for the Contracting State : FR, IT, NL)
1. Hydroterphenyls of the formula I


wherein

R^1 is alkyl,

R^2 is H, OH, CN, alkyl, —O-alkyl, —COOR³ or —O—CO—R³,

R^3 is H, alkyl, —Cy-alkyl, —Ph-alkyl, —Ph—O-alkyl, —Ph—CN or —Ph—F,

Cy is 1,4-cyclohexylene and

Ph is 1,4-phenylene,

and the alkyl groups each contain 1-10 C atoms.

2. Process for the preparation of hydroterphenyls of the formula I according to Claim 1, characterised in that a compound which corresponds to the formula I but contains (a) reduceable group(s) and/or additional C-C bonds instead of hydrogen atoms, is treated with a reducing agent, and in that, where relevant, the radical R^2 in a resulting compound of the formula I is converted into another radical R^2 .

3. Use of the compounds of the formula I according to Claim 1 as components of liquid crystal dielectrics for electrooptical display elements.

4. Liquid crystal dielectric for electrooptical display elements with at least two liquid crystal components, characterised in that at least one component is a compound of the formula I according to Claim 1.

5. Electrooptical display element, characterised in that it contains a dielectric according to Claim 4.

Claims (for the Contracting State: CH, DE, GB, LI)
1. Hydroterphenyls of the formula I


wherein

R^1 is alkyl,

R^2 is OH, CN, —COOR³ or —O—CO—R³,

R^3 is H, alkyl, —Cy-alkyl, —Ph-alkyl, —Ph—O-alkyl, —Ph—CN or —Ph—F,

Cy is 1,4-cyclohexylene and

Ph is 1,4-phenylene,

and the alkyl groups each contain 1-10 C atoms.

2. Process for the preparation of hydroterphenyls of the formula I according to Claim 1, characterised in that a compound which corresponds to the formula I but contains (a) reduceable group(s) and/or additional C-C bonds instead of hydrogen atoms, is treated with a reducing agent, and in that, where relevant, the radical R^2 in a resulting compound of the formula I is converted into another radical R^2 .

3. Use of the compounds of the formula I according to Claim 1 as components of liquid crystal dielectrics for electrooptical display elements.

4. Liquid crystal dielectric for electrooptical display elements with at least two liquid crystal components, characterised in that at least one component is a compound of the formula I according to Claim 1.

5. Electrooptical display element, characterised in that it contains a dielectric according to Claim 4.

Claims (for Contracting State AT)
1. Process for the preparation of hydroterphenyls of the formula I


wherein

R^1 is alkyl,

R^2 is H, OH, CN, Alkyl, —O-alkyl, —COOR³ or —O—CO—R³,

R^3 is H, alkyl, —Cy-alkyl, —Ph-alkyl, —Ph—O-alkyl, —Ph—CN or —Ph—F,

Cy is 1,4-cyclohexylene and

Ph is 1,4-phenylene,



and the alkyl groups each contain 1-10 C atoms, characterised in that a compound which corresponds to the formula I but contains (a) reduceable group(s) and/or additional C-C bonds instead of hydrogen atoms, is treated with a reducing agent, and in that, where relevant, the radical R^2 in a resulting compound of the formula I is converted into another radical R^2 .

2. Use of the compounds of the formula I according to Claim 1 as components of liquid crystal dielectrics for electrooptical display elements.

3. Liquid crystal dielectric for electrooptical display elements with at least two liquid crystal components, characterised in that at least one component is a compound of the formula I according to Claim 1.

4. Electrooptical display element, characterised in that it contains a dielectric according to Claim 3.

Revendications (pour les Etats contractants : FR, IT, NL)

1. Hydroterphényles de formule I



dans laquelle

R^1 représente un groupe alkyle,

R^2 représente H, OH, CN, un groupe alkyle, O-alkyle, $-COOR^3$ ou $-O-CO-R^3$;

R^3 représente H, un groupe alkyle, $-Cy$ -alkyle, Ph-alkyle, Ph-O-alkyle, $-Ph-CN$ ou $-Ph-F$;

Cy représente un groupe 1,4-cyclohexylène ; et

Ph représente un groupe 1,4-phénylène ;

les groupes alkyle contenant chacun 1 à 10 atomes de carbone.

2. Procédé de préparation des hydroterphényles de formule I selon la revendication 1, caractérisé en ce que l'on traite par un agent réducteur un composé répondant à la formule I mais qui porte à la place des atomes d'hydrogène un ou plusieurs groupes réductibles et/ou des liaisons C-C supplémentaires, et le cas échéant, dans un composé de formule I ainsi obtenu, on convertit le substituant R^2 en un autre substituant R^2 .

3. Utilisation des composés de formule I selon la revendication 1 en tant que composants diélectriques à cristaux liquides pour des éléments d'affichage électro-optiques.

4. Diélectrique à cristaux liquides pour éléments d'affichage électro-optiques contenant au moins deux composants à cristaux liquides, caractérisé en ce que l'un au moins des composants est un composé de formule I selon la revendication 1.

5. Élément d'affichage électro-optique, caractérisé en ce qu'il contient un diélectrique selon la revendication 4.

Revendications (pour les Etats contractants : CH, DE, GB, LI)

1. Hydroterphényles de formule I



dans laquelle

R^1 représente un groupe alkyle,

R^2 représente OH, CN, $-COOR^3$ ou $-O-CO-R^3$;

R^3 représente H, un groupe alkyle, $-Cy$ -alkyle, Ph-alkyle, Ph-O-alkyle, $-Ph-CN$ ou $-Ph-F$;

Cy représente un groupe 1,4-cyclohexylène ; et

Ph représente un groupe 1,4-phénylène ;

les groupes alkyle contenant chacun 1 à 10 atomes de carbone.

2. Procédé de préparation des hydroterphényles de formule I selon la revendication 1, caractérisé en ce que l'on traite par un agent réducteur un composé répondant à la formule I mais qui porte à la place des atomes d'hydrogène un ou plusieurs groupes réductibles et/ou des liaisons C-C supplémentaires, et le cas échéant, dans un composé de formule I ainsi obtenu, on convertit le substituant R^2 en un autre substituant R^2 .

3. Utilisation des composés de formule I selon la revendication 1 en tant que composants diélectriques à cristaux liquides pour des éléments d'affichage électro-optiques.

4. Diélectrique à cristaux liquides pour éléments d'affichage électro-optiques contenant au moins deux composants à cristaux liquides, caractérisé en ce que l'un au moins des composants est un composé de formule I selon la revendication 1.

5. Élément d'affichage électro-optique, caractérisé en ce qu'il contient un diélectrique selon la revendication 4.



Revendications (pour l'Etat contractant AT)

1. Procédé de préparation des hydroterphényles de formule I



dans laquelle

R^1 représente un groupe alkyle,

R^2 représente H, OH, CN, un groupe alkyle, O-alkyle, $-COOR^3$ ou $-O-CO-R^3$;

R^3 représente H, un groupe alkyle, $-Cy$ -alkyle, Ph-alkyle, Ph-O-alkyle, $-Ph-CN$ ou $-Ph-F$;

Cy représente un groupe 1,4-cyclohexylène ; et

Ph représente un groupe 1,4-phénylène ;

les groupes alkyle contenant chacun 1 à 10 atomes de carbone, caractérisé en ce que l'on traite par un agent réducteur un composé répondant à la formule I mais qui porte à la place des atomes d'hydrogène un ou plusieurs groupes réductibles et/ou des liaisons C-C supplémentaires, et le cas échéant, dans un composé de formule I ainsi obtenu, on convertit le substituant R^2 en un autre substituant R^2 .

2. Utilisation des composés de formule I selon la revendication 1 en tant que composants diélectriques à cristaux liquides pour des éléments d'affichage électro-optiques.

3. Diélectrique à cristaux liquides pour éléments d'affichage électro-optiques contenant au moins deux composants à cristaux liquides, caractérisé en ce que l'un au moins des composants est un composé de formule I selon la revendication 1.

4. Élément d'affichage électro-optique, caractérisé en ce qu'il contient un diélectrique selon la revendication 3.