

30	R-Ph-Z-PhF-CN	I dj
	RO-Ph-Z-PhF-CN	I dk
	R-Ph-Z-Ph-F	I dm
	RO-Ph-Z-Ph-F	I dn
	F-Z-Ph-Cy-R	I l
	R-Cy-Z-Ph-F	I n
	R-Cy-Z-PhF-F	I od
	R-Cy-Z-PhF-CN	I oe
35	F-Z-PhF-Cy-R	I pc
	NC-Z-PhF-Cy-R	I pd
	R-Z-PhF-Ph-CN	I qd
	R-Z-PhF-Ph-F	I qe
	NC-Z-PhF-Ph-R	I qf
	NC-Z-PhF-Ph-OR	I qg

wherein

Ph is 1,4-phenylene,

PhF is 2- or 3-fluoro-1,4-phenylene,

Cy is 1,4-cyclohexylene,

5 R is an alkyl group with 1 to 12 C atoms, and

Z is 1,3-pyrimidine-2,5-diyl

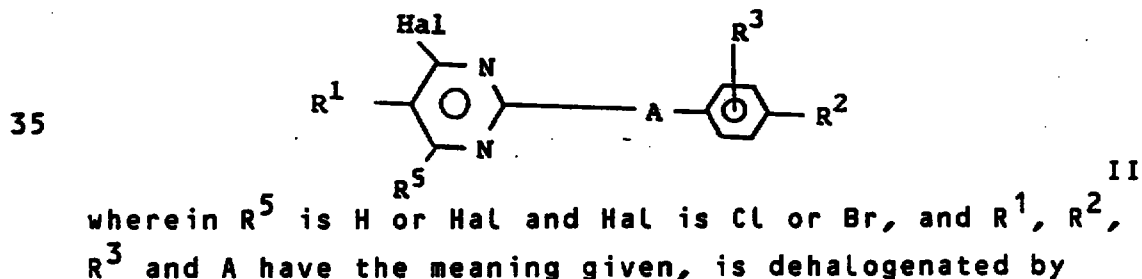
are outstandingly suitable for the preparation of liquid crystal mixtures with a reduced tendency to form smectic phases at low temperatures, and have low k_{33}/k_{11} quotients

10 (k_{33} = elastic bending constant, k_{11} = elastic spreading constant; the slope of the characteristic line of the multiplexible mixture, inter alia, depends on the quotient k_{33}/k_{11}). These compounds have a wide field of application: depending on the choice of substituents, they can
15 be used as base materials of which liquid crystal dielectrics predominantly consist, but liquid crystal base materials from other classes of compounds can also be added to the compounds of the formula I in order thus to prepare dielectrics with an extended liquid crystal mesophase or
20 to influence the level of dielectric anisotropy of such a dielectric.

The compounds of the formula I are colourless in the pure state and form low-viscosity nematic mesophases in a wide temperature range favourably located for electro-
25 optical use. They are very stable to chemicals, heat and light. Similar compounds, that is to say, liquid crystal 5-alkyl-2-(4-acyloxyphenyl)-pyrimidines, are described in EP-A-25119.

The invention thus relates to the compounds of the
30 formula I and to a process for their preparation, characterised in that

(a) a halogenopyrimidine of the formula II



reduction, or in that

(b) a compound which corresponds to the formula I but contains one or more amino groups instead of one or more fluorine atoms is diazotised, the diazotisation product is converted into the corresponding diazonium tetrafluoborate and this is decomposed by means of heat.

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

The fluorine-containing pyrimidine derivatives of the formula I according to the invention include, in particular, the preferred compounds of the following formulae Ia to Iq

	$R^1-Z-Ph-F$	Ia
	$R^1-Z-PhF-R^2$	Ib
20	$R^1-Z-Ph-Ph-F$	Ic
	$R^4-Ph-Z-PhR^3-R^2$	Id
	$F-Z-Ph-R^2$	Ie
	$R^1-Z-Ph-PhF-R^2$	If
	$F-Ph-Z-Ph-Ph-R^4$	Ig
25	$F-Z-Ph-Ph-R^2$	Ih
	$R^1-Z-Cy-Ph-F$	Ii
	$R^1-Z-Cy-PhF-R^2$	Ij
	$R^1-Z-PhF-Cy-R$	Ik
	$F-Z-Ph-Cy-R$	Il
30	$F-Z-Cy-Ph-R^2$	Im
	$R-Cy-Z-Ph-F$	In
	$R-Cy-Z-PhF-R^2$	Io
	$R^1-Z-PhR^3-Cy-R$	Ip
	$R^1-Z-PhR^3-Ph-R^4$	Iq

wherein Ph is 1,4-phenylene, PhF is 2- or 3-fluoro-1,4-phenylene, Cy is 1,4-cyclohexylene and R^1 , R^2 , R^3 and Z have the meaning given for formula I.

Particularly preferred compounds of the above

formulae Ia to Iq, are those of the formulae Ia, Ic, Ie, Ig - In and Ip, especially Ia, Ij, In and Ip.

In the compounds of the formula I above and below which contain a 1,4-cyclohexylene group, those which contain a trans-1,4-cyclohexylene group are preferred.

In the compounds of the formula I, the radicals R^1 and R^2 can be H, R or OR, and one of them can also be CN or F, wherein the alkyl radical R can preferably be straight-chain, but can also be branched, and is preferably methyl, ethyl, n-propyl, n-butyl, n-pentyl, n-hexyl, n-heptyl, n-octyl, n-nonyl, n-decyl, n-undecyl or n-dodecyl.

In preferred compounds of the formula I, one of the radicals R^1 and R^2 is alkyl and the other is CN or F, in particular CN.

Compounds of the formula I with a branched end group R^1 or R^2 are sometimes of importance because of their better solubility in the customary liquid crystal base materials, but in particular as chiral doping substances, if they possess optical activity as a result of the chain branching. Such branched end groups preferably contain not more than one chain branching. Preferred branched hydrocarbon radicals are those in which a methyl or ethyl group is present in the 1-, 2- or 3-position on a longer carbon chain, for example 2-methylpropyl, 2-methylbutyl, 3-methylbutyl, 2-methylpentyl, 3-methylpentyl, 2-ethylhexyl or 1-methylhexyl.

Preferred compounds of the formula I are those in which R^1 and R^2 together contain 3 to 14, in particular 4 to 12, carbon atoms. Compounds of the formula I in which the radicals R^1 and/or R^2 contain alkyl groups R with 2 to 8, in particular 3 to 6, carbon atoms are preferred. Compounds of the formula I in which one of the radicals R^1 or R^2 is 4-R-phenyl, 4-RO-phenyl, 4-cyanophenyl, 4-fluorophenyl or trans-4-R-cyclohexyl, in particular 4-cyanophenyl or 4-fluorophenyl, are also preferred.

The preferred compounds of part formula Ia include those of part formulae Iaa and Iab:

R-Z-Ph-F Iaa

RO-Z-Ph-F Iab

The preferred compounds of part formula Ib include those of part formulae Iba to Ibg:

5 R-Z-PhF-R Iba

R-Z-PhF-OR Ibb

R-Z-PhF-CN Ibc

R-Z-PhF-F Ibd

NC-Z-PhF-R Ibf

10 NC-Z-PhF-OR Ibg

Of these, those of the part formulae 1bc, 1bd, 1bf and 1bg are particularly preferred.

The preferred compounds of part formula Ic include those of part formulae Ica and Icb:

15 R-Z-Ph-Ph-F Ica

RO-Z-Ph-Ph-F Icb

The preferred compounds of part formula Id include those of part formulae Ida to Idq:

R-Ph-Z-PhF-R Ida

20 R-Ph-Z-PhF-OR Idb

RO-Ph-Z-PhF-R Idd

RO-Ph-Z-PhF-OR Ide

R-Ph-Z-PhF-CN Idj

RO-Ph-Z-PhF-CN Idk

25 R-Ph-Z-Ph-F Idm

RO-Ph-Z-Ph-F Idn

F-Ph-Z-Ph-R Idp

F-Ph-Z-Ph-OR Idq

30 Of these, those of the part formulae 1dj to 1dq are particularly preferred.

The preferred compounds of part formula Ie include those of part formulae Iea and Ieb:

F-Z-Ph-R Iea

F-Z-Ph-OR Ieb

35 The preferred compounds of part formula If include those of part formulae Ifa to Ifg:

R-Z-Ph-PhF-R Ifa

R-Z-Ph-PhF-OR Ifb

R-Z-Ph-PhF-CN Ifd

R-Z-Ph-PhF-F Ife

NC-Z-Ph-PhF-R Iff

NC-Z-Ph-PhF-OR Ifg

5 Of these, those of the part formulae 1fd to 1fg are particularly preferred.

The preferred compounds of part formula Ig include those of part formulae Iga and 1gb:

F-Ph-Z-Ph-Ph-R Iga

10 F-Ph-Z-Ph-Ph-OR Igb

The preferred compounds of part formula Ih include those of part formulae Iha and 1hb:

F-Z-Ph-Ph-R Iha

F-Z-Ph-Ph-OR Ihb

15 The preferred compounds of part formula Ii include those of part formulae Iia and Iib:

R-Z-Cy-Ph-F Iia

RO-Z-Cy-Ph-F Iib

20 The preferred compounds of part formula Ij include those of part formulae Ija to Ijg:

R-Z-Cy-PhF-R Ija

R-Z-Cy-PhF-OR Ijb

R-Z-Cy-PhF-CN Ijd

R-Z-Cy-PhF-F Ije

25 N-Z-Cy-PhF-R Ijf

NC-Z-Cy-PhF-OR Ijg

The preferred compounds of part formula Io include those of part formulae Ioa to Ioe:

R-Cy-Z-PhF-R Ioa

30 R-Cy-Z-PhF-OR Iob

R-Cy-Z-PhF-F Iod

R-Cy-Z-PhF-CN Ioe

Of these, those of the part formulae 1od and 1oe are particularly preferred.

35 The preferred compounds of part formula Ip include those of part formulae Ipa to Ipd:

R-Z-PhF-Cy-R Ipa

F-Z-Ph-Cy-R Ipb

F-Z-PhF-Cy-R Ipc

NC-Z-PhF-Cy-R Ipd

Of these, those of the part formulae 1pa and 1pd are particularly preferred.

5 The preferred compounds of part formula Iq include those of part formulae Iqa to Iqg:

R-Z-PhF-Ph-R Iqa

R-Z-PhF-Ph-OR Iqb

R-Z-PhF-Ph-CN Iqd

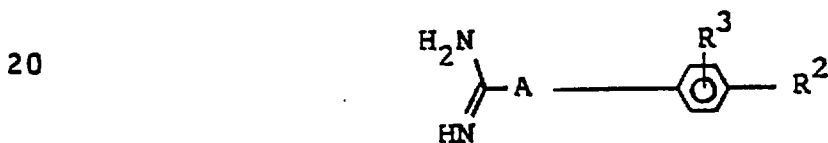
10 R-Z-PhF-Ph-F Iqe

NC-Z-PhF-Ph-R Iqf

NC-Z-PhF-Ph-OR Iqg

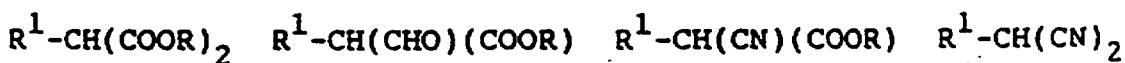
Of these, those of the part formulae 1qd to 1qg are particularly preferred.

15 The compounds of the formula I are preferably prepared by reductive dehalogenation of the compounds of the formula II. Compounds of the formula II are preferably prepared by condensation of an amidine of the formula III



III

wherein R^2 , R^3 and A have the meaning given, or of one of its functional derivatives, with a malonic acid derivative of the formula IV, a formylacetic acid derivative of the formula V, a cyanoacetic acid derivative of the formula VI or a malonic acid dinitrile of the formula VII



30 IV V VI VII
wherein the radicals R^1 and R in each case have the meaning given, if appropriate hydrolysis and subsequent halogenation.

35 The reductive dehalogenation of the compounds of the formula II is carried out by methods which are known per se, for example preferably with hydrogen in the presence of a catalyst in the presence of an inert solvent at temperatures between -80 and $+50^\circ$, preferably between

-20 and +30°, under pressures between 1 and 2 bar. Suitable catalysts are most of the customary hydrogenation catalysts, preferably palladium-on-charcoal or Raney nickel. In principle, all the solvents usual for such
5 hydrogenations can be employed as the solvent. Particularly suitable solvents are hydrocarbons, preferably benzene, toluene or xylenes, and alcohols, preferably methanol, ethanol, isopropanol or n-propanol. The reaction is preferably carried out in the presence of a base, preferably an organic amine, such as, for example, triethyl-
10 amine.

The compounds of the formula I are furthermore obtainable by diazotisation of corresponding amines and subsequent replacement of the diazonium groups by F atoms,
15 for example by the Schiemann method.

The diazotisation, reaction to give the diazonium tetrafluoroborate and thermal decomposition (Schiemann-Balz synthesis) can be carried out in a manner which is known per se, for example in accordance with one of the process
20 variants described in "Organic Reactions", Volume 5 (1949), pages 193 - 228.

The starting substances can be obtained, for example, by nitration of corresponding pyrimidine derivatives which correspond to the formula I but contain hydro-
25 gen atoms instead of one or more F atoms; the resulting nitro compounds can then be reduced to the amino compounds, for example with tin and hydrochloric acid or by catalytic hydrogenation.

Some of the starting compounds of the formulae
30 II to VII used in the syntheses described are known, and they can all be prepared analogously to the known starting compounds by standard processes of preparative organic chemistry in a manner which is customary per se.

The dielectrics according to the invention consist of 2 to 15, preferably 3 to 12, components, at least
35 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

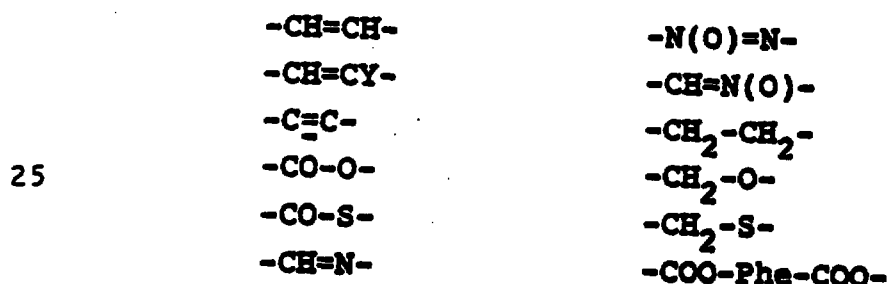


from the classes of azoxybenzenes, benzylideneanilines, biphenyls, terphenyls, phenyl or cyclohexyl benzoates, phenyl or cyclohexyl cyclohexane-carboxylates, phenylcyclohexanes, cyclohexylbiphenyls, cyclohexylcyclohexanes, cyclohexylnaphthalenes, 1,4-bis-cyclohexylbenzenes, 4,4'-bis-cyclohexylbiphenyls, phenyl- or cyclohexyl-pyrimidines, phenyl- or cyclohexyl-dioxanes, 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 are characterised by the formula VIII



wherein E1 and E2 are each 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 tetra-hydronaphthalene, quinazoline and tetrahydroquinazoline, G is



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

In most of these compounds, R' and R'' differ from one another, one of these radicals usually being an alkyl or alkoxy group. However, other variants of the substituents envisaged are also usual. The 1,4-disubstituted

benzene rings in these compounds can also be substituted laterally by F or CN. Many such substances or mixtures thereof are commercially available, and all these substances can be prepared by methods which are known from the literature.

The dielectrics according to the invention contain about 0.1 to 100, preferably 10 to 100%, of compounds of the formula I, at least two compounds of the formula I being present if other compounds are absent.

10 The dielectrics according to the invention are 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 15 invention can be modified by suitable additives such that they can be used in all the types of liquid crystal display elements hitherto 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 tetraphenylboranate or complex salts of crown ethers (compare, for example, B.I. Haller et al., Mol.Cryst.Liq.Cryst., Volume 24, pages 249 - 258 (1973)) can be added to improve the conductivity, 25 dichroic dyestuffs can be added to produce coloured guest-host systems or substances can be added to modify the dielectric anisotropy, the viscosity and/or the orientation of the nematic phases. Substances of this type are described, for example, in German Offenlegungsschriften 30 2,209,127, 2,240,864, 2,321,632, 2,338,281, 2,450,088, 2,637,430, 2,853,728 and 2,902,177.

The following examples are intended to illustrate the invention without limiting it. M.p. = melting point, c.p. = clear point. Percentages given above and below 35 denote percentages by weight; all the temperatures are given in degrees Celsius.

Example 1

53 g of 2-p-fluorophenyl-4,6-dichloro-5-n-hexyl-

pyrimidine [obtainable by reaction of p-fluorobenzonitrile with ethanol/HCl to give p-fluorobenzimidazole ester hydrochloride, reaction with ethanolic NH₃ to give p-fluorobenzimidazole hydrochloride, reaction with diethyl n-hexylmalonate to give 2-p-fluorophenyl-4,6-dihydroxy-5-n-hexylpyrimidine and heating with POCl₃/dimethylaniline] are dissolved in 750 ml of ethanol and 75 ml of triethylamine and the solution is hydrogenated on 25 g of 5% Pd-on-C at 20° under 1 bar until somewhat more than the calculated amount of hydrogen has been taken up. The mixture is filtered, the filtrate is evaporated and the residue is purified by dissolving in methylene chloride, washing the solution with water, dilute hydrochloric acid and again with water and evaporating again to give 2-p-fluorophenyl-5-n-hexylpyrimidine, m.p. 39° (from ethanol).

The following compounds are prepared analogously:

- 2-p-fluorophenyl-5-methylpyrimidine
- 2-p-fluorophenyl-5-ethylpyrimidine
- 2-p-fluorophenyl-5-n-propylpyrimidine
- 20 2-p-fluorophenyl-5-n-butylpyrimidine
- 2-p-fluorophenyl-5-n-pentylpyrimidine
- 2-p-fluorophenyl-5-n-heptylpyrimidine
- 2-p-fluorophenyl-5-n-octylpyrimidine
- 2-p-fluorophenyl-5-n-nonylpyrimidine, m.p. 23.5°
- 25 2-p-fluorophenyl-5-n-decylpyrimidine
- 2-p-fluorophenyl-5-n-undecylpyrimidine and
- 2-p-fluorophenyl-5-n-dodecylpyrimidine.

Example 2

8.8 g of 2-(3-amino-4-n-dodecyloxyphenyl)-5-n-hexylpyrimidine [m.p. 57.5°, obtainable by reaction of 2-(4-n-dodecyloxyphenyl)-5-n-hexylpyrimidine with nitric acid to give 2-(3-nitro-4-n-dodecyloxyphenyl)-5-n-hexylpyrimidine and subsequent reduction with H₂/Raney nickel] are dissolved in 25 ml of dioxane at 50° and 25 ml of 35% tetrafluoroboric acid are added dropwise, with stirring. After one hour, the resulting emulsion is cooled to 0°, whereupon crystallisation occurs. A solution of 2.4 g of sodium nitrite in 25 ml of water is added to the

suspension and the mixture is stirred for one hour. The resulting diazonium tetrafluoroborate is filtered off with suction, washed with ice-water and dried. 5 g of the diazonium salt are heated at 200° until the evolution of gas has ended. 2-(3-Fluoro-4-n-dodecyloxyphenyl)-5-n-hexylpyrimidine of m.p. 51.5° and c.p. 44° is obtained by purification by chromatography.

The following compounds are prepared analogously:

- 2-(3-fluoro-4-(trans-4-n-butylcyclohexyl)-phenyl)-5-n-butylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-butylcyclohexyl)-phenyl)-5-n-pentylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-butylcyclohexyl)-phenyl)-5-n-hexylpyrimidine
- 15 2-(3-fluoro-4-(trans-4-n-butylcyclohexyl)-phenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-butylcyclohexyl)-phenyl)-5-n-octylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-pentylcyclohexyl)-phenyl)-5-n-butylpyrimidine
- 20 2-(3-fluoro-4-(trans-4-n-pentylcyclohexyl)-phenyl)-5-n-pentylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-pentylcyclohexyl)-phenyl)-5-n-hexylpyrimidine
- 25 2-(3-fluoro-4-(trans-4-n-pentylcyclohexyl)-phenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-pentylcyclohexyl)-phenyl)-5-n-octylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-hexylcyclohexyl)-phenyl)-5-n-butylpyrimidine
- 30 2-(3-fluoro-4-(trans-4-n-hexylcyclohexyl)-phenyl)-5-n-pentylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-hexylcyclohexyl)-phenyl)-5-n-hexylpyrimidine
- 35 2-(3-fluoro-4-(trans-4-n-hexylcyclohexyl)-phenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-hexylcyclohexyl)-phenyl)-5-n-octylpyrimidine

- 2-(3-fluoro-4-(trans-4-n-heptylcyclohexyl)-phenyl)-5-n-butylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-heptylcyclohexyl)-phenyl)-5-n-pentylpyrimidine
- 5 2-(3-fluoro-4-(trans-4-n-heptylcyclohexyl)-phenyl)-5-n-hexylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-heptylcyclohexyl)-phenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-heptylcyclohexyl)-phenyl)-5-n-octylpyrimidine
- 10 2-(3-fluoro-4-(trans-4-n-octylcyclohexyl)-phenyl)-5-n-butylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-octylcyclohexyl)-phenyl)-5-n-pentylpyrimidine
- 15 2-(3-fluoro-4-(trans-4-n-octylcyclohexyl)-phenyl)-5-n-hexylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-octylcyclohexyl)-phenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-(trans-4-n-octylcyclohexyl)-phenyl)-5-n-octylpyrimidine
- 20 2-(3-fluoro-4-n-butylphenyl)-5-(4-n-butylphenyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(4-n-pentylphenyl)-pyrimidine
- 25 2-(3-fluoro-4-n-butylphenyl)-5-(4-n-hexylphenyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(4-n-heptylphenyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(4-n-octylphenyl)-pyrimidine
- 30 2-(3-fluoro-4-n-pentylphenyl)-5-(4-n-butylphenyl)-pyrimidine
- 2-(3-fluoro-4-n-pentylphenyl)-5-(4-n-pentylphenyl)-pyrimidine
- 35 2-(3-fluoro-4-n-pentylphenyl)-5-(4-n-hexylphenyl)-pyrimidine
- 2-(3-fluoro-4-n-pentylphenyl)-5-(4-n-heptylphenyl)-pyrimidine

- 2-(3-fluoro-4-n-pentylphenyl)-5-(4-n-octylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(4-n-butylphenyl)-
pyrimidine
- 5 2-(3-fluoro-4-n-hexylphenyl)-5-(4-n-pentylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(4-n-hexylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(4-n-heptylphenyl)-
10 pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(4-n-octylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(4-n-butylphenyl)-
pyrimidine
- 15 2-(3-fluoro-4-n-heptylphenyl)-5-(4-n-pentylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(4-n-hexylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(4-n-heptylphenyl)-
20 pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(4-n-octylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-octylphenyl)-5-(4-n-butylphenyl)-
pyrimidine
- 25 2-(3-fluoro-4-n-octylphenyl)-5-(4-n-pentylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-octylphenyl)-5-(4-n-hexylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-octylphenyl)-5-(4-n-heptylphenyl)-
30 pyrimidine
- 2-(3-fluoro-4-n-octylphenyl)-5-(4-n-octylphenyl)-
pyrimidine
- 2-(3-fluoro-4-n-butoxyphenyl)-5-n-butylpyrimidine
- 2-(3-fluoro-4-n-butoxyphenyl)-5-n-pentylpyrimidine
- 35 2-(3-fluoro-4-n-butoxyphenyl)-5-n-hexylpyrimidine
- 2-(3-fluoro-4-n-butoxyphenyl)-5-n-heptylpyrimidine
- 2-(3-fluoro-4-n-butoxyphenyl)-5-n-octylpyrimidine
- 2-(3-fluoro-4-n-pentyloxyphenyl)-5-n-butylpyrimidine

- 2-(3-fluoro-4-n-pentyloxyphenyl)-5-n-pentylpyrimidine
2-(3-fluoro-4-n-pentyloxyphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-pentyloxyphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-pentyloxyphenyl)-5-n-octylpyrimidine
5 2-(3-fluoro-4-n-hexyloxyphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-hexyloxyphenyl)-5-n-pentylpyrimidine
2-(3-fluoro-4-n-hexyloxyphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-hexyloxyphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-hexyloxyphenyl)-5-n-octylpyrimidine
10 2-(3-fluoro-4-n-heptyloxyphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-heptyloxyphenyl)-5-n-pentylpyrimidine
2-(3-fluoro-4-n-heptyloxyphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-heptyloxyphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-heptyloxyphenyl)-5-n-octylpyrimidine
15 2-(3-fluoro-4-n-octyloxyphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-octyloxyphenyl)-5-n-pentylpyrimidine
2-(3-fluoro-4-n-octyloxyphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-octyloxyphenyl)-5-n-heptylpyrimidine and
2-(3-fluoro-4-n-octyloxyphenyl)-5-n-octylpyrimidine.

20 Example 3

56 g of 2-(3-amino-4-n-pentylphenyl)-5-n-hexylpyrimidine [m.p. 92°, obtainable by reaction of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine (c.p. 28.5°) with nitric acid to give 2-(3-nitro-4-n-pentylphenyl)-5-n-hexylpyrimidine (m.p. 41.5°) and hydrogenation on Raney nickel] are
25 dissolved in 150 ml of dioxane at 50° and 208 ml of 35% tetrafluoboric acid are added dropwise, with stirring. After one hour, the resulting emulsion is cooled to 0°, whereupon crystallisation occurs. A solution of 20 g of
30 sodium nitrite in 150 ml of water is added to the suspension and the mixture is stirred for one hour. The resulting diazonium tetrafluoborate is filtered off with suction, washed with ice-water and dried. 5 g of the diazonium salt are heated at 200° until the evolution of gas
35 has ended. 2-(3-Fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine of m.p. 30° is obtained by purification by chromatography.

The following compounds are prepared analogously:



- 2-(3-fluoro-4-n-butylphenyl)-5-(trans-4-n-butylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(trans-4-n-pentylcyclohexyl)-pyrimidine
- 5 2-(3-fluoro-4-n-butylphenyl)-5-(trans-4-n-hexylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(trans-4-n-heptylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-butylphenyl)-5-(trans-4-n-octylcyclohexyl)-pyrimidine
- 10 2-(3-fluoro-4-n-pentylphenyl)-5-(trans-4-n-butylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-pentylphenyl)-5-(trans-4-n-pentylcyclohexyl)-pyrimidine
- 15 2-(3-fluoro-4-n-pentylphenyl)-5-(trans-4-n-hexylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-pentylphenyl)-5-(trans-4-n-heptylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-pentylphenyl)-5-(trans-4-n-octylcyclohexyl)-pyrimidine
- 20 2-(3-fluoro-4-n-hexylphenyl)-5-(trans-4-n-butylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(trans-4-n-pentylcyclohexyl)-pyrimidine
- 25 2-(3-fluoro-4-n-hexylphenyl)-5-(trans-4-n-hexylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(trans-4-n-heptylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-hexylphenyl)-5-(trans-4-n-octylcyclohexyl)-pyrimidine
- 30 2-(3-fluoro-4-n-heptylphenyl)-5-(trans-4-n-butylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(trans-4-n-pentylcyclohexyl)-pyrimidine
- 35 2-(3-fluoro-4-n-heptylphenyl)-5-(trans-4-n-hexylcyclohexyl)-pyrimidine
- 2-(3-fluoro-4-n-heptylphenyl)-5-(trans-4-n-heptylcyclohexyl)-pyrimidine



- 2-(3-fluoro-4-n-heptylphenyl)-5-(trans-4-n-octylcyclohexyl)-pyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-(trans-4-n-butylcyclohexyl)-pyrimidine
5 2-(3-fluoro-4-n-octylphenyl)-5-(trans-4-n-pentylcyclohexyl)-pyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-(trans-4-n-hexylcyclohexyl)-pyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-(trans-4-n-heptylcyclohexyl)-pyrimidine
10 2-(3-fluoro-4-n-octylphenyl)-5-(trans-4-n-octylcyclohexyl)-pyrimidine
2-(3-fluoro-4-n-butylphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-butylphenyl)-5-n-pentylpyrimidine
15 2-(3-fluoro-4-n-butylphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-butylphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-butylphenyl)-5-n-octylpyrimidine
2-(3-fluoro-4-n-pentylphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-pentylphenyl)-5-n-pentylpyrimidine
20 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-pentylphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-pentylphenyl)-5-n-octylpyrimidine
2-(3-fluoro-4-n-hexylphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-hexylphenyl)-5-n-pentylpyrimidine
25 2-(3-fluoro-4-n-hexylphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-hexylphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-hexylphenyl)-5-n-octylpyrimidine
2-(3-fluoro-4-n-heptylphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-heptylphenyl)-5-n-pentylpyrimidine
30 2-(3-fluoro-4-n-heptylphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-heptylphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-heptylphenyl)-5-n-octylpyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-n-butylpyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-n-pentylpyrimidine
35 2-(3-fluoro-4-n-octylphenyl)-5-n-hexylpyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-n-heptylpyrimidine
2-(3-fluoro-4-n-octylphenyl)-5-n-octylpyrimidine
2-cyano-5-(3-fluoro-4-n-butylphenyl)-pyrimidine

2-cyano-5-(3-fluoro-4-n-pentylphenyl)-pyrimidine
 2-cyano-5-(3-fluoro-4-n-hexylphenyl)-pyrimidine
 2-cyano-5-(3-fluoro-4-n-heptylphenyl)-pyrimidine and
 2-cyano-5-(3-fluoro-4-n-octylphenyl)-pyrimidine.

5 Example 4

82.6 g of 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-
 4,6-dichloro-5-n-nonylpyrimidine [m.p. 51°, obtainable by
 reaction of 4-n-pentyl-2-fluoro-4'-cyanobiphenyl, m.p.
 54°, with ethanol/HCl and ethanolic NH₃ to give the cor-
 10 responding amidine hydrochloride, reaction with diethyl
 n-nonyl malonate to give 2-(2'-fluoro-4'-n-pentylbiphenyl-
 4-yl)-4,6-dihydroxy-5-n-nonylpyrimidine and heating with
 POCl₃/dimethylaniline] are dissolved in 750 ml of ethanol
 and 75 ml of triethylamine and the solution is hydrogen-
 15 ated and worked up analogously to Example 1. 2-(2'-Fluoro-
 4'-n-pentylbiphenyl-4-yl)-5-n-nonylpyrimidine of m.p. 51°,
 S/N 81° and c.p. 131° is obtained.

The following compounds are prepared analogously:

- 20 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-butyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-pentyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-hexyl-
 pyrimidine
- 25 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-heptyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-octyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-butylbiphenyl-4-yl)-5-n-nonyl-
 30 pyrimidine
- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-butyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-pentyl-
 pyrimidine
- 35 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-hexyl-
 pyrimidine
- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-heptyl-
 pyrimidine



- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-octyl-
pyrimidine
- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-decyl-
pyrimidine
- 5 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-undecyl-
pyrimidine
- 2-(2'-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-dodecyl-
pyrimidine
- 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-butyl-
10 pyrimidine
- 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 15 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-heptyl-
pyrimidine
- 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-octyl-
pyrimidine
- 2-(2'-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-nonyl-
20 pyrimidine
- 2-(2'-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-butyl-
pyrimidine
- 2-(2'-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 25 2-(2'-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 2-(2'-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-heptyl-
pyrimidine
- 2-(2'-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-octyl-
30 pyrimidine
- 2-(2'-fluoro-4'-n-octylbiphenyl-4-yl)-5-n-butyl-
pyrimidine
- 2-(2'-fluoro-4'-n-octylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 35 2-(2'-fluoro-4'-n-octylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 2-(2'-fluoro-4'-n-octylbiphenyl-4-yl)-5-n-heptyl-
pyrimidine

- 2-(2'-fluoro-4'-n-octylbiphenyl-4-yl)-5-n-octyl-
pyrimidine
- 2-(2-fluorobiphenyl-4-yl)-5-n-butylpyrimidine
- 2-(2-fluorobiphenyl-4-yl)-5-n-pentylpyrimidine
- 5 2-(2-fluorobiphenyl-4-yl)-5-n-hexylpyrimidine
- 2-(2-fluorobiphenyl-4-yl)-5-n-heptylpyrimidine
- 2-(2-fluorobiphenyl-4-yl)-5-n-octylpyrimidine
- 2-(2-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-butyl-
pyrimidine
- 10 2-(2-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 2-(2-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 2-(2-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-heptyl-
15 pyrimidine
- 2-(2-fluoro-4'-n-pentylbiphenyl-4-yl)-5-n-octyl-
pyrimidine
- 2-(2-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-butyl-
pyrimidine
- 20 2-(2-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 2-(2-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 2-(2-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-heptyl-
25 pyrimidine
- 2-(2-fluoro-4'-n-hexylbiphenyl-4-yl)-5-n-octyl-
pyrimidine
- 2-(2-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-butyl-
pyrimidine
- 30 2-(2-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-pentyl-
pyrimidine
- 2-(2-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-hexyl-
pyrimidine
- 2-(2-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-heptyl-
35 pyrimidine and
- 2-(2-fluoro-4'-n-heptylbiphenyl-4-yl)-5-n-octyl-
pyrimidine.

Example A

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A liquid crystal mixture of

- 14.2% of 4-(trans-4-propylcyclohexyl)-benzonitrile
- 19.2% of 4-(trans-4-n-pentylcyclohexyl)-benzonitrile
- 13.3% of 4-(trans-4-n-propylcyclohexyl)-ethoxybenzene
- 5 10.0% of 4-(trans-4-n-propylcyclohexyl)-butoxybenzene
- 18.4% of 4-(trans-4-n-pentylcyclohexyl)-4'-ethylbiphenyl
- 8.3% of 4-(trans-4-n-pentylcyclohexyl)-4'-(trans-4-n-propylcyclohexyl)-biphenyl and
- 16.6% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine
- 10 has a smectic/nematic phase transition at -12° and a clear point of 72° . By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a clear point of 65° and shows no smectic
- 15 phase down to -20° .

Example B

A liquid crystal mixture of

- 12.6% of 4-(trans-4-propylcyclohexyl)-benzonitrile
- 17.0% of 4-(trans-4-n-pentylcyclohexyl)-benzonitrile
- 20 11.8% of 4-(trans-4-n-propylcyclohexyl)-ethoxybenzene
- 8.9% of 4-(trans-4-n-propylcyclohexyl)-butoxybenzene
- 16.3% of 4-(trans-4-n-pentylcyclohexyl)-4'-ethylbiphenyl
- 7.4% of 4-(trans-4-n-pentylcyclohexyl)-4'-(trans-4-n-propylcyclohexyl)-biphenyl and
- 25 26.0% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine
- has a smectic/nematic phase transition at $+24^{\circ}$ and a clear point of 63° .

- By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a
- 30 liquid crystal mixture is obtained which has a nematic phase range from $+11^{\circ}$ to $+53^{\circ}$.

Example C

A liquid crystal mixture of

- 16.7% of 4-(trans-4-ethylcyclohexyl)-benzonitrile
- 35 8.3% of 4-(trans-4-n-butylcyclohexyl)-benzonitrile
- 10.8% of 4-ethyl-4'-cyanobiphenyl
- 18.3% of 4-n-butyl-4'-cyanobiphenyl
- 16.7% of 4-(trans-4-n-propylcyclohexyl)-phenyl trans-4-

n-butylcyclohexanecarboxylate

12.5% of 4-(trans-4-n-propylcyclohexyl)-phenyl trans-4-n-pentylcyclohexanecarboxylate (sic) and

16.7% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine

- 5 has a smectic/nematic phase transition at -8° and a clear point of 58° . By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a nematic phase range from -18° to $+52^{\circ}$.

10 Example D

A liquid crystal mixture of

14.8% of 4-(trans-4-ethylcyclohexyl)-benzonitrile

7.4% of 4-(trans-4-n-butylcyclohexyl)-benzonitrile

9.6% of 4-ethyl-4'-cyanobiphenyl

- 15 16.4% of 4-n-butyl-4'-cyanobiphenyl

14.8% of 4-(trans-4-n-propylcyclohexyl)-phenyl trans-4-n-butylcyclohexanecarboxylate

11.1% of 4-(trans-4-n-propylcyclohexyl)-phenyl trans-4-n-pentylcyclohexanecarboxylate and

- 20 25.9% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine
has a smectic/nematic phase transition at $+15^{\circ}$ and a clear point of 51° .

- By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a
25 nematic phase range from $+1^{\circ}$ to $+41^{\circ}$.

Example E

A liquid crystal mixture of

12.6% of 4-(trans-5-n-propyl-1,3-dioxan-2-yl)-benzonitrile

- 30 17.0% of 4-(trans-5-n-butyl-1,3-dioxan-2-yl)-benzonitrile

10.4% of 4-ethyl-4'-cyanobiphenyl

19.2% of 4-n-butyl-4'-cyanobiphenyl

5.9% of 4-(trans-4-n-pentylcyclohexyl)-4'-cyanobiphenyl

- 35 3.7% of 4-cyanophenyl 4-(trans-4-ethylcyclohexyl)-benzoate

5.2% of 4-cyanophenyl 4-(trans-4-n-pentylcyclohexyl)-benzoate and

26.0% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine

has a smectic/nematic phase transition at 0° and a clear point of 47° .

By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a nematic phase range from -20° to $+36^{\circ}$.

Example F

A liquid crystal mixture of

- 11.1% of 4-(trans-4-n-propylcyclohexyl)-benzonitrile
- 10 20.0% of 4-(trans-4-n-propylcyclohexyl)-ethylbenzene
- 7.4% of 4-(trans-4-n-propylcyclohexyl)-ethoxybenzene
- 5.2% of 4-(trans-4-n-pentylcyclohexyl)-4'-cyanobiphenyl
- 6.7% of 4-(trans-4-n-propylcyclohexyl)-4'-ethylbiphenyl
- 5.9% of 4-(trans-4-n-pentylcyclohexyl)-4'-ethylbiphenyl
- 15 7.4% of 4-(trans-4-n-pentylcyclohexyl)-4'-(trans-4-n-propylcyclohexyl)-biphenyl
- 5.9% of 4-n-propylphenyl 4-(trans-4-n-propylcyclohexyl)-benzoate
- 4.4% of 4-n-propylphenyl 4-(trans-4-n-pentylcyclohexyl)-benzoate and
- 20 26.0% of 2-(4-n-pentylphenyl)-5-n-hexylpyrimidine

has a smectic/nematic phase transition of -17° and a clear point of 58° .

By replacing the last component by the same amount of 2-(3-fluoro-4-n-pentylphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a nematic phase range from $<-20^{\circ}$ to $+48^{\circ}$.

Example G

A liquid crystal mixture of

- 30 9% of 4-(trans-5-n-propyl-1,3-dioxan-2-yl)-benzonitrile
- 12% of 4-(trans-5-n-butyl-1,3-dioxan-2-yl)-benzonitrile
- 9% of 4-(trans-5-n-pentyl-1,3-dioxan-2-yl)-benzonitrile
- 6% of 2-(4-n-heptyloxyphenyl)-5-n-hexylpyrimidine
- 22% of 2-(4-n-octyloxyphenyl)-5-n-hexylpyrimidine
- 35 6% of 2-(4-n-nonyloxyphenyl)-5-n-hexylpyrimidine
- 6% of 2-(4-n-decyloxyphenyl)-5-n-hexylpyrimidine
- 10% of 4-ethoxyphenyl trans-4-n-propylcyclohexanecarboxylate

- 24 -

10% of 4-ethoxyphenyl trans-4-n-butylcyclohexanecarboxylate and

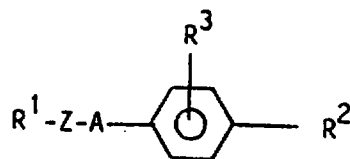
10% of 4-(trans-4-n-propylcyclohexyl)-4'-ethylbiphenyl has a melting point of -10° , a clear point of 61° and a
5 smectic/nematic phase transition at $+21^{\circ}$.

By replacing 13% of the pyrimidine content of the above mixture by 2-(3-fluoro-4-n-dodecyloxyphenyl)-5-n-hexylpyrimidine, a liquid crystal mixture is obtained which has a melting point of -12° , a clear point of 58°
10 and a smectic/nematic phase transition below -20° . The mixture is distinguished by an advantageous threshold voltage and a steep characteristic line (small v_{50}/v_{10} ratio) and is thus outstandingly suitable for multiplex operation.



Patent claims

1. Fluorine-containing pyrimidine compounds of the formula I



I
wherein R^1 and R^2 are H, R or OR, wherein one of them is also CN or F, or, if A is a covalent bond, also 4- R^4 -phenyl or 4-R-cyclohexyl, wherein R^4 is R, OR, CN or F and R is an alkyl group with 1 to 12 C atoms, R^3 is F or, if one of the radicals R^1 or R^2 is F or 4-fluorophenyl, also H, Z is 1,3-pyrimidin-2,5-diyl and A is 1,4-phenylene, 1,4-cyclohexylene or a covalent bond and also of the formulae

R-Ph-Z-PhF-CN	I dj
RO-Ph-Z-PhF-CN	I dk
R-Ph-Z-Ph-F	I dm
RO-Ph-Z-Ph-F	I dn
F-Z-Ph-Cy-R	I l
R-Cy-Z-Ph-F	I n
R-Cy-Z-PhF-F	I od
R-Cy-Z-PhF-CN	I oe

F-Z-PhF-Cy-R	I pc
NC-Z-PhF-Cy-R	I pd

R-Z-PhF-Ph-CN	I qd
R-Z-PhF-Ph-F	I qe
NC-Z-PhF-Ph-R	I qf
NC-Z-PhF-Ph-OR	I qg

wherein

Ph is 1,4-phenylene,

PhF is 2- or 3-fluoro-1,4-phenylene,

Cy is 1,4-cyclohexylene,

R is an alkyl group with 1 to 12

C atoms, and



Z is 1,3-pyrimidine-2,5-diyl.

2. Pyrimidine compounds according to Claim 1, characterized by the formulae Ia and Ic



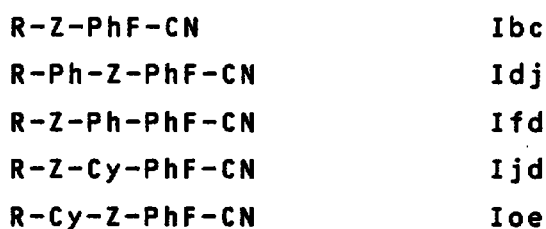
wherein

R^1 is straight-chain alkyl with 2 to 8 carbon atoms,

Z is 1,3-pyrimidine-2,5-diyl and

Ph is 1,4-phenylene.

3. Pyrimidine compounds according to Claim 1, characterized by the formulae Ibc, Idj, Ifd, Ijd and Ioe,



wherein

R is straight-chain alkyl with 2 to 8 carbon atoms,

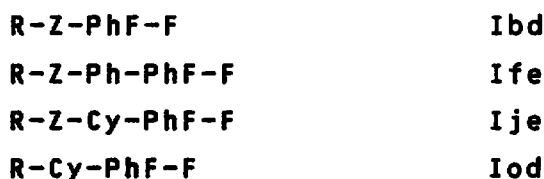
Z is 1,3-pyrimidine-2,5-diyl,

Ph is 1,4-Phenylene,

Cy is 1,4-cyclohexylene and

PhF is 2- or 3-fluoro-1,4-phenylene.

4. Pyrimidine compounds according to Claim 1, characterized by the formulae Ibd, Ife, Ije and Iod,



wherein

R is straight-chain alkyl with 2 to 8 carbon atoms,

Z is 1,3-pyrimidine-2,5-diyl,

Ph is 1,4-phenylene,

Cy is 1,4-cyclohexylene and

PhF is 2- or 3-fluoro-1,4-phenylene.

5. Pyrimidine compounds according to Claim 1, characterized in that one of the radicals R^1 and R^2 is trans-4-R-cyclohexyl.

6. Pyrimidine compounds according to Claim 1,

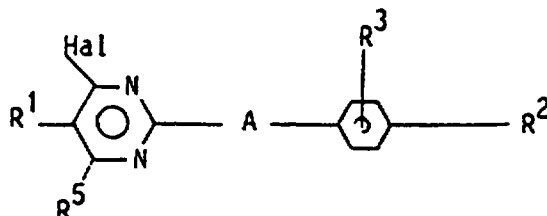


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characterized in that one of the radicals R^1 and R^2 is alkyl and the other is CN.

7. Process for the preparation of fluorine-containing pyrimidine compounds of the formula I according to Claim 1, characterized in that

(a) a halogenopyrimidine of the formula II



II

wherein R^5 is H or Hal and Hal is Cl or Br, and R^1 , R^2 , R^3 and A have the meaning given, is dehalogenated by reduction, or in that

(b) a compound which corresponds to the formula I but contains one or more amino groups instead of one or more fluorine atoms is diazotised, the diazotisation product is converted into the corresponding diazonium tetrafluoroborate and this is decomposed by means of heat.

8. Use of the compounds according to one of Claims 1 to 6, as components of liquid crystal dielectrics for electrooptical display elements.

9. Liquid crystal dielectric for electrooptical display elements with at least two liquid crystal components, characterized in that at least one component is a compound according to one of Claims 1 to 6.

10. Electrooptical display element, characterized in that it contains a dielectric according to Claim 9.

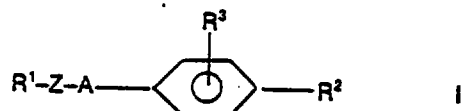


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As printed

Claims

1. Fluorine-containing pyrimidine compounds of the formula I



wherein R¹ and R² are H, R or OR, wherein one of them is also CN or F, or, if A is a covalent bond, also 4-R⁴-phenyl or 4-R-cyclohexyl, wherein R⁴ is R, OR, CN or F and R is an alkyl group with 1 to 12 C atoms, R³ is F or, if one of the radicals R¹ or R² is F or 4-fluorophenyl, also H, Z is 1,3-pyrimidine-2,5-diyl and A is 1,4-phenylene, 1,4-cyclohexylene or a covalent bond and also of the formulae

R-Ph-Z-PhF-CN	I dj
RO-Ph-Z-PhF-CN	I dk
R-Ph-Z-Ph-F	I dm
RO-Ph-Z-Ph-F	I dn
F-Z-Ph-Cy-R	I l
R-Cy-Z-Ph-F	I n
R-Cy-Z-PhF-F	I od
R-Cy-Z-PhF-CN	I oe
F-Z-PhF-Cy-R	I pc
NC-Z-PhF-Cy-R	I pd
R-Z-PhF-Ph-CN	I qd
R-Z-PhF-Ph-F	I qe
NC-Z-PhF-Ph-R	I qf
NC-Z-PhF-Ph-OR	I qg

wherein

Ph is 1,4-phenylene,
PhF is 2- or 3-fluoro-1,4-phenylene,
Cy is 1,4-cyclohexylene,
R is an alkyl group with 1 to 12 C atoms, and
Z is 1,3-pyrimidine-2,5-diyl.

2. Pyrimidine compounds according to Claim 1, characterized by the formulae I a and I c

R¹-Z-Ph-F	I a
R¹-Z-Ph-Ph-F	I c

wherein

R¹ is straight-chain alkyl with 2 to 8 carbon atoms,

Z is 1,3-pyrimidine-2,5-diyl and
Ph is 1,4-phenylene.

3. Pyrimidine compounds according to Claim 1, characterized by the formulae I bc, I dj, I fd, I jd and I oe,

R-Z-PhF-CN	I bc
R-Ph-Z-PhF-CN	I dj
R-Z-Ph-PhF-CN	I fd
R-Z-Cy-PhF-CN	I jd
R-Cy-Z-PhF-CN	I oe

wherein

R is straight-chain alkyl with 2 to 8 carbon atoms,

Z is 1,3-pyrimidine-2,5-diyl,
Ph is 1,4-phenylene,
Cy is 1,4-cyclohexylene and
PhF is 2- or 3-fluoro-1,4-phenylene.

4. Pyrimidine compounds according to Claim 1, characterized by the formulae I bd, I fe, I je and I od,

R-Z-PhF-F	I bd
R-Z-Ph-PhF-F	I fe
R-Z-Cy-PhF-F	I je
R-Cy-PhF-F	I od

wherein

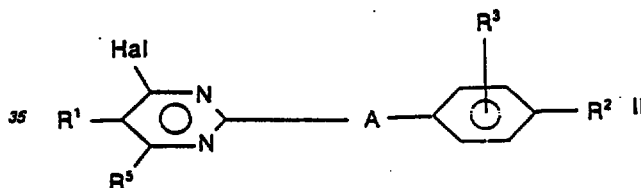
R is straight-chain alkyl with 2 to 8 carbon atoms,

Z is 1,3-pyrimidine-2,5-diyl,
Ph is 1,4-phenylene,
Cy is 1,4-cyclohexylene and
PhF is 2- or 3-fluoro-1,4-phenylene.

5. Pyrimidine compounds according to Claim 1, characterized in that one of the radicals R¹ and R² is trans-4-R-cyclohexyl.

6. Pyrimidine compounds according to Claim 1, characterized in that one of the radicals R¹ and R² is alkyl and the other is CN.

7. Process for the preparation of fluorine-containing pyrimidine compounds of the formula I according to Claim 1, characterized in that
(a) a halogenopyrimidine of the formula II



wherein R⁵ is H or Hal and Hal is Cl or Br, and R¹, R², R³ and A have the meaning given, is dehalogenated by reduction, or in that

(b) a compound which corresponds to the formula I but contains one or more amino groups instead of one or more fluorine atoms is diazotised, the diazotisation product is converted into the corresponding diazonium tetrafluoroborate and this is decomposed by means of heat.

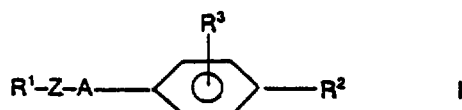
8. Use of the compounds according to one of Claims 1 to 6, as components of liquid crystal dielectrics for electrooptical display elements.

9. Liquid crystal dielectric for electrooptical display elements with at least two liquid crystal components, characterized in that at least one component is a compound according to one of Claims 1 to 6.

10. Electrooptical display element, characterized in that it contains a dielectric according to Claim 9.

Revendications

1. Composés de la pyrimidine contenant du fluor de formule I



dans laquelle

R¹ et R² représentent H, R, ou OR, et l'un d'entre eux est aussi CN ou F, ou, si A est une liaison covalente, ils représentent aussi un 4-R⁴-phényle ou un 4-R-cyclohexyle, où R⁴ représente R, OR, CN ou F, et R est un groupe alkyle ayant de 1 à 12 atomes de C, R³ représente F ou aussi H si l'un des restes R¹ ou R² est F ou un 4-fluorophényle,

Z est un 1,3-pyrimidine-2,5-divyle et

A est un 1,4-phénylène, un 1,4-cyclohexylène ou une liaison covalente.

ainsi que ceux de formules

R-Ph-Z-PhF-CN	ldj
RO-Ph-Z-PhF-CN	ldk
R-Ph-Z-Ph-F	ldm
RO-Ph-Z-Ph-F	ldn
F-Z-Ph-Cy-R	ll
R-Cy-Z-Ph-F	ln
R-Cy-Z-PhF-F	lod
R-Cy-Z-PhF-CN	loe
F-Z-PhF-Cy-R	lpc
NC-Z-PhF-Cy-R	lpd
R-Z-PhF-Ph-CN	lqd
R-Z-PhF-Ph-F	lqe
NC-Z-PhF-Ph-R	lqi
NC-Z-PhF-Ph-OR	lqq

dans lesquelles

Ph est un 1,4-phénylène,

PhF est un 2- ou 3-fluoro-1,4-phénylène.

Cy est une 1,4-cyclohexylène.

R est un groupe alkyle ayant de 1 à 12 atomes de C, et

Z est une 1,3-pyrimidine-2,5-diyle.

2. Composés de la pyrimidine selon la revendication 1, caractérisés par les formules I a et I c

$R^1-Z-Ph-F$	1a
$R^1-Z-Ph-Ph-F$	1c

dans lesquelles

R¹ représente un alkyle à chaîne droite ayant de 2 à 8 atomes de carbone.

Z représente une 1,3-pyrimidine-2,5-diyle, et
Ph représente un 1,4-phénylène.

3. Composés de la pyrimidine selon la revendication 1, caractérisés par les formules I bc, I dj, I fd, I jd et I oe,

R-Z-PhF-CN	l bc
R-Ph-Z-PhF-CN	l dj
R-Z-Ph-PhF-CN	l fd
R-Z-Cy-PhF-CN	l jd
R-Cy-Z-PhF-CN	l oe

dans lesquelles

R représente un alkyle à chaîne droite ayant de 2 à 8 atomes de carbone.

Z représente une 1,3-pyrimidine-2,5-diyle,

Ph représente un 1,4-phénylène,

Cy représente un 1,4-cyclohexylène, et

PhF représente un 2- ou 3-fluoro-1,4-phénylène.

4. Composés de la pyrimidine selon la revendication 1, caractérisés par les formules I bd, I fe, I je et I od.

R-Z-PhF-F	l bd
R-Z-Ph-PhF-F	l fe
R-Z-Cy-PhF-F	l je
R-Cy-Z-PhF-F	l od

dans lesquelles

R représente un alkyle à chaîne droite ayant de 2 à 8 atomes de carbone.

Z représente une 1,3-pyrimidine-2,5-diyle,

Ph représente un 1,4-phénylène.

Cy représente un 1,4-cyclohexylène, et

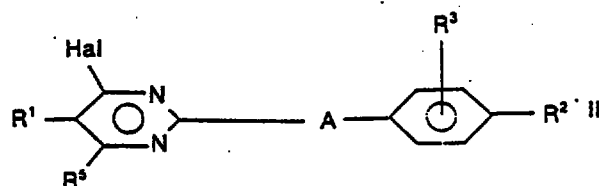
PhF représente un 2- ou 3-fluoro-1,4-phénylène.

5. Dérivés de la pyrimidine selon la revendication 1, caractérisés en ce que un des restes R¹ et R² est un trans-4-R-cyclohexyle.

6. Dérivés de la pyrimidine selon la revendication 1, caractérisés en ce qu'un des restes R^1 et R^2 est un alkyle et l'autre est CN.

7. Procédé pour préparer des composés de la pyrimidine contenant du fluor de formule I selon la revendication 1, caractérisé en ce que

(a) on déshalogène par réduction une halogé-
nopyrimidine de formule II



dans laquelle

R^5 représente H ou Hal, et

Hal représente Cl ou Br, et R^1 , R^2 , R^3 et A ont les significations données précédemment, ou

(b) on diazote un composé correspondant à la formule I, mais qui comporte un ou plusieurs groupements amine à la place d'un ou plusieurs atomes de fluor, on le transforme en tétrafluoroborate de diazonium correspondant, et on décompose celui-ci thermiquement.

8. Utilisation des composés selon l'une des revendications 1 à 6 comme composants de diélectriques à cristaux liquides pour des éléments indicateurs électrooptiques.

9. Diélectrique à cristaux liquides pour éléments indicateurs électrooptiques comportant au moins deux composants à cristaux liquides, caractérisé en ce que au moins un composant est un composé selon l'une des revendications 1 à 6.

10. Élément indicateur électrooptique, caractérisé en ce qu'il comporte un diélectrique selon la revendication 9.

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