trimethoxysilane, 3-diphenylphosphinopropyltriethoxysilane, 3-diphenylphosphinopropylmethyldimethoxysilane, S-trimethylsilylmercaptopropylmethyldimethoxysilane, S-trimethylsilylmercaptopropyltrimethoxysilane, S-trimethylsilylmercaptopropyltriethoxysilane, S-trimethylsilylmercaptopropylmethyldiethoxysilane, and compounds in which the alkyl groups or alkylene groups in the above compounds are replaced with alkyl groups or alkylene groups having 1 to 6 carbon atoms.

[0098]

Of these, examples of preferred compounds include 3-diphenylphosphinopropyltrimethoxysilane, 3-diphenylphosphinopropyltriethoxysilane, S-trimethylsilylmercaptopropylmethyldimethoxysilane, S-trimethylsilylmercaptopropyltrimethoxysilane, and S-trimethylsilylmercaptopropyltriethoxysilane, and S-trimethylsilylmercaptopropylmethyldiethoxysilane.

[0099]

The modification reaction can be performed, for examples, as a solution reaction. The solution reaction may be performed using a solution containing an unreacted monomer after completion of the polymerization reaction or the like. Moreover, the modification reaction is preferably carried out after completion of the polymerization or the like and before performing a solvent-removing treatment, a treatment with water, a thermal treatment, and several operations necessary for isolation of the polymer. Furthermore, the modification reaction may be performed batchwise using a batch-type reaction vessel or may be performed continuously using an apparatus such as a multi-stage continuous reaction vessel.

[0100]

In the modification reaction, the reaction temperature may be about the same temperature as the aforementioned polymerization temperature and is preferably from -20 to 150°C, more preferably from 0 to 120°C, and particularly preferably from 20 to 100°C. When the reaction temperature is low, there is a tendency that the viscosity of the modified conjugated diene polymer increases. When the reaction temperature is high, the active point of the modified conjugated diene polymer is prone to be deactivated. The reaction time of the modification reaction is preferably from 1 minute to 5 hours, and more preferably from 2 minutes to 1 hour.

[0101]

The amount of the modifier to be used in the modification reaction is preferably 0.1 molar equivalent or more, and more preferably 0.3 molar equivalent or more relative to the active point of the conjugated diene polymer. When the amount is the above value or more, the modification reaction sufficiently proceeds, dispersibility of a reinforcing agent such as carbon black or silica is improved, and the abrasion resistance, wet skid resistance,

[Table 5]

Table 5

			Example 1D	Comparative Example 1D	Comparative Example 1D'	Example 2D	Comparative Example 2D	Example 3D	Comparative Example 3D
Component (I): Hydrogenated conjugated diene polymer	Kind		synthesized in Example 1C	synthesized in Comparative Example 1C	synthesized in Comparative Example 1C'	synthesized in Example 2C	synthesized in Comparative Example 2C	synthesized in Example 3C	synthesized in Comparative Example 3C
	Solvent (g)	cyclohexane	24000	24000	24000	24000	24000	22000	22000
	Vinyl content regulator (g)	tetrahydrofuran	568	568	568	201	201		
		2,2-di(tetrahydrofuryl)propane						7.4	7.4
	Polymerization monomer (g)	First stage: styrene	473	473	473	472	472	562	562
		Second stage: butadiene	4471	4471	4471	44714771	44714771	5184	5184
		Third stage: styrene	316	316	316			375	375
		Fourth stage: butadiene						125	125
	Polymerization initiator (g)	n-butyllithium	5.5	5.5	5.5	6.6	6.6	5.6	5.6
		N-(tert-butyldimethylsilyl)piperazine	11.1			13.1		11.3	
		piperidine		4.7					
	Coupling agent (g)	methyldichlorosilane				3.2	3.2		
	Modifier (g)	N,N-bis(trimethylsilyl)aminopropyl-methyldiethoxysilane						22.7	22.7
	Weight-average molecular weight ($\times 10^4$)		12.5	13.0	12.5	17.0	17.0	13.5	13.5
	Vinyl bond content (mol%)		79	79	79	64	64	80	80
	Styrene unit content (% by mass)		15	15	15	9	9	15	15
	Coupling rate (%)		-	-	-	60	60	-	-
	Hydrogenation rate (%)		98	98	98	98	98	98	98
	MRF (g/10 min)		30	30	30	7	7	15	15
Component (I)	% by mass		5	5	5	5	5	5	5
Component (II-1): PP	% by mass		68	68	68	68	68	68	68
Component (II-2): PLA	% by mass		27	27	27	27	27	27	27
Rigidity	MPa		1180	1260	1260	1320	1380	1140	1200
Impact resistance	KJ/m^2		3	2.2	2.4	3.2	2.4	4.8	3.4
Surface impact resistance	J		6	4	2	4	2	11	7
Tensile elongation at break	%		12	19	10	5	3	20	12
Specularity			O	O	O	O	O	O	O
Delamination			O	O	O	O	O	O	O

Component (I): hydrated conjugated diene polymer obtained in each of Examples and the like

PLA: polylactic acid (trade name "Ingeo 3001D" manufactured by Nature Works LLC)

PP: polypropylene (trade name "BC06C" manufactured by Japan Polypropylene Corporation)

Processing temperature: 200°C