11th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2007, Hammamet, Tunisia, 05-09 September, 2007.

A DEPOSITIONAL RUBBER MIXTURE AND ITS CHOOSEN PROPERTIES

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ABSTRACT
A depositional rubber mixture used for textile cord rubberizing must provide a lot of properties, because each of both materials has other character. One of many problems is filler dispersion into rubber matrix. This fact influence on the other parameters like chemical, mechanical and adhesion properties.
Present work deals with electric parameter measurement and the next influence on mechanical and adhesion properties.
Keywords: depositional rubber mixture, electric parameters, fillers, treatment properties.

1. INTRODUCTION
A deposit mixture, which is used in rubber tire production, must provide a lot of properties especially good driven properties, fatigue resistance, long period of service, good adhesion, minimal rolling resistance and so on [1].
In generally, rubber mixture has unique composition. It consists of various chemical structures, by little feed changes influence on individual mechanical properties as strength, extension, hardness, adhesion and so on. In this experimental work we used deposit mixture for textile cord treatment. In connection with its low adhesion was traditional rubber blend modified. Rubber blend modification consists of NBR caoutchouc feeding, filler, adhesion agents or softener feeding. Filler and caoutchouc feeding can influence quite problem with its dispersion and distribution into rubber matrix. Then could be the final mixed rubber blend inhomogeneous which influence on its treatment properties e.g. mechanical and partly chemical – electrical and adhesion properties of rubber blend, which is included in tire [2, 3, 4].

2. EXPERIMENTAL PART
Mechanical properties like strength, hardness, modulus M100, extension and chemicals properties like adhesion were measured at certified laboratory apparatus. For strength, modulus, extension and adhesion of H-test /static/ or Henley test /dynamic/ was used equipment Instron 4302, hardness was measured at Shore hardness tester. Measured data are included in table 1.

Table 1. Measured treatment properties of modified rubber blends.

Property	Blend 1	Blend 2
Strength [MPa]	17,6	17,9
Extension [%]	598	568
Modulus M100 [MPa]	1,87	2,16
Hardness [ShA]	54,5	59,6
Static adhesion [N]	109	130
Dynamic adhesion [N]	104	120

Opposite the programmable automatic RCL meter with PC data connection measured the electrical parameters like capacity, resistance, impedance, phase angle, dissipation and quality factor in dependence of frequency. View of real apparatus is seen on the picture 1.

Figure 1.Programmable automatic RCL meter.

Measured schema is in serial connection of two parameters - capacity and resistance, and then is possible to calculate the other parameters – loss angle, conductivity, real and imaginary part of permitivity /ε´, ε´´/; see the tables 2 and 3.

Table2. Measured values of modified rubber blend 1.

R [Ω]	C[F]	Z[Ω]	Φ	Q	D	f[Hz]	tan δ	ε´	ε´´	σ [S/m]
7,86E+04	4,77E-12	3,34E+06	-88,7	42,4	0,024	10000	2,36E-02	1,10E+01	2,58E-01	1,44E-07
7,10E+04	4,76E-12	3,04E+06	-88,7	42,8	0,023	11000	2,34E-02	1,09E+01	2,55E-01	1,56E-07
6,50E+04	4,76E-12	2,79E+06	-88,7	42,9	0,023	12000	2,33E-02	1,09E+01	2,55E-01	1,70E-07
5,92E+04	4,79E-12	2,56E+06	-88,7	43,2	0,023	13000	2,32E-02	1,10E+01	2,55E-01	1,84E-07
5,47E+04	4,79E-12	2,38E+06	-88,7	43,4	0,023	14000	2,31E-02	1,10E+01	2,54E-01	1,98E-07
5,11E+04	4,8E-12	2,21E+06	-88,7	43,3	0,023	15000	2,31E-02	1,10E+01	2,55E-01	2,13E-07
4,78E+04	4,79E-12	2,08E+06	-88,7	43,4	0,023	16000	2,30E-02	1,10E+01	2,53E-01	2,25E-07
4,50E+04	4,79E-12	1,96E+06	-88,7	43,4	0,023	17000	2,30E-02	1,10E+01	2,54E-01	2,40E-07
4,24E+04	4,79E-12	1,85E+06	-88,7	43,6	0,023	18000	2,30E-02	1,10E+01	2,53E-01	2,53E-07
4,04E+04	4,78E-12	1,75E+06	-88,7	43,4	0,023	19000	2,30E-02	1,10E+01	2,53E-01	2,67E-07
3,85E+04	4,78E-12	1,67E+06	-88,7	43,3	0,023	20000	2,31E-02	1,10E+01	2,54E-01	2,82E-07
3,65E+04	4,78E-12	1,59E+06	-88,7	43,4	0,023	21000	2,30E-02	1,10E+01	2,53E-01	2,96E-07
3,47E+04	4,77E-12	1,52E+06	-88,7	43,7	0,023	22000	2,29E-02	1,10E+01	2,50E-01	3,07E-07
3,30E+04	4,77E-12	1,45E+06	-88,7	44,0	0,023	23000	2,27E-02	1,10E+01	2,49E-01	3,19E-07
3,12E+04	4,77E-12	1,39E+06	-88,7	44,5	0,022	24000	2,25E-02	1,10E+01	2,46E-01	3,28E-07
3,01E+04	4,77E-12	1,34E+06	-88,7	44,4	0,023	25000	2,25E-02	1,10E+01	2,47E-01	3,43E-07
2,89E+04	4,77E-12	1,28E+06	-88,7	44,4	0,023	26000	2,25E-02	1,10E+01	2,47E-01	3,57E-07
2,77E+04	4,76E-12	1,24E+06	-88,7	44,6	0,022	27000	2,24E-02	1,09E+01	2,45E-01	3,68E-07
2,67E+04	4,76E-12	1,19E+06	-88,7	44,8	0,022	28000	2,23E-02	1,09E+01	2,44E-01	3,80E-07
2,56E+04	4,76E-12	1,15E+06	-88,7	45,0	0,022	29000	2,22E-02	1,09E+01	2,43E-01	3,92E-07
2,47E+04	4,76E-12	1,12E+06	-88,7	45,1	0,022	30000	2,22E-02	1,09E+01	2,42E-01	4,05E-07
2,38E+04	4,76E-12	1,08E+06	-88,7	45,3	0,022	31000	2,21E-02	1,09E+01	2,42E-01	4,17E-07
2,31E+04	4,75E-12	1,05E+06	-88,7	45,3	0,022	32000	2,21E-02	1,09E+01	2,40E-01	4,28E-07
2,24E+04	4,75E-12	1,02E+06	-88,7	45,4	0,022	33000	2,20E-02	1,09E+01	2,40E-01	4,41E-07
2,17E+04	4,75E-12	9,86E+05	-88,7	45,4	0,022	34000	2,20E-02	1,09E+01	2,40E-01	4,54E-07
2,10E+04	4,75E-12	9,58E+05	-88,7	45,6	0,022	35000	2,19E-02	1,09E+01	2,40E-01	4,66E-07
2,04E+04	4,75E-12	9,32E+05	-88,7	45,6	0,022	36000	2,19E-02	1,09E+01	2,39E-01	4,79E-07
1,99E+04	4,75E-12	9,07E+05	-88,7	45,6	0,022	37000	2,19E-02	1,09E+01	2,39E-01	4,93E-07
1,94E+04	4,75E-12	8,83E+05	-88,7	45,6	0,022	38000	2,19E-02	1,09E+01	2,40E-01	5,06E-07
1,89E+04	4,74E-12	8,61E+05	-88,7	45,6	0,022	39000	2,19E-02	1,09E+01	2,39E-01	5,18E-07
1,84E+04	4,74E-12	8,39E+05	-88,7	45,6	0,022	40000	2,19E-02	1,09E+01	2,38E-01	5,31E-07

1,72E+04	4,74E-12	7,91E+05	-88,8	45,9	0,022	42500	2,18E-02	1,09E+01	2,37E-01	5,61E-07
1,65E+04	4,73E-12	7,47E+05	-88,7	45,4	0,022	45000	2,20E-02	1,09E+01	2,39E-01	5,99E-07
1,59E+04	4,73E-12	7,09E+05	-88,7	44,7	0,022	47500	2,24E-02	1,09E+01	2,43E-01	6,43E-07
1,51E+04	4,73E-12	6,74E+05	-88,7	44,6	0,022	50000	2,24E-02	1,09E+01	2,44E-01	6,78E-07
1,43E+04	4,73E-12	6,42E+05	-88,7	44,7	0,022	52500	2,24E-02	1,09E+01	2,43E-01	7,10E-07
1,37E+04	4,73E-12	6,12E+05	-88,7	44,8	0,022	55000	2,23E-02	1,09E+01	2,43E-01	7,43E-07
1,31E+04	4,73E-12	5,86E+05	-88,7	44,7	0,022	57500	2,24E-02	1,09E+01	2,43E-01	7,79E-07
1,26E+04	4,72E-12	5,62E+05	-88,7	44,6	0,022	60000	2,24E-02	1,08E+01	2,43E-01	8,12E-07

Table3. Measured values of modified rubber blend 2.

R [Ω]	C[F]	Z[Ω]	Φ	Q	D	f[Hz]	tan δ	ε´	ε´´	σ [S/m]
2,75E+05	6,6E-12	2,43E+06	-83,5	8,77	0,114	10000	1,14E-01	1,52E+01	1,73E+00	9,62E-07
2,48E+05	6,56E-12	2,22E+06	-83,6	8,90	0,112	11000	1,12E-01	1,51E+01	1,69E+00	1,04E-06
2,26E+05	6,53E-12	2,04E+06	-83,7	8,99	0,111	12000	1,11E-01	1,50E+01	1,67E+00	1,11E-06
2,07E+05	6,49E-12	1,90E+06	-83,7	9,09	0,110	13000	1,10E-01	1,49E+01	1,64E+00	1,19E-06
1,92E+05	6,46E-12	1,77E+06	-83,8	9,17	0,109	14000	1,09E-01	1,48E+01	1,62E+00	1,26E-06
1,75E+05	6,52E-12	1,64E+06	-83,9	9,31	0,107	15000	1,07E-01	1,50E+01	1,61E+00	1,34E-06
1,63E+05	6,49E-12	1,54E+06	-83,9	9,40	0,106	16000	1,06E-01	1,49E+01	1,58E+00	1,41E-06
1,53E+05	6,47E-12	1,45E+06	-84,0	9,48	0,105	17000	1,05E-01	1,49E+01	1,57E+00	1,48E-06
1,44E+05	6,45E-12	1,38E+06	-84,0	9,54	0,105	18000	1,05E-01	1,48E+01	1,55E+00	1,55E-06
1,35E+05	6,43E-12	1,31E+06	-84,1	9,61	0,104	19000	1,04E-01	1,48E+01	1,54E+00	1,62E-06
1,28E+05	6,42E-12	1,25E+06	-84,1	9,66	0,103	20000	1,03E-01	1,47E+01	1,53E+00	1,70E-06
1,22E+05	6,4E-12	1,19E+06	-84,1	9,73	0,103	21000	1,03E-01	1,47E+01	1,51E+00	1,76E-06
1,16E+05	6,38E-12	1,14E+06	-84,2	9,80	0,102	22000	1,02E-01	1,47E+01	1,49E+00	1,83E-06
1,10E+05	6,37E-12	1,09E+06	-84,2	9,87	0,101	23000	1,01E-01	1,46E+01	1,48E+00	1,90E-06
1,05E+05	6,35E-12	1,05E+06	-84,2	9,92	0,101	24000	1,01E-01	1,46E+01	1,47E+00	1,96E-06
1,01E+05	6,34E-12	1,01E+06	-84,3	9,98	0,100	25000	1,00E-01	1,46E+01	1,46E+00	2,03E-06
9,65E+04	6,33E-12	9,73E+05	-84,3	10,03	0,100	26000	9,97E-02	1,45E+01	1,45E+00	2,10E-06
9,26E+04	6,31E-12	9,39E+05	-84,3	10,09	0,099	27000	9,91E-02	1,45E+01	1,44E+00	2,16E-06
8,90E+04	6,3E-12	9,07E+05	-84,4	10,14	0,099	28000	9,86E-02	1,45E+01	1,43E+00	2,22E-06
8,56E+04	6,29E-12	8,77E+05	-84,4	10,19	0,098	29000	9,81E-02	1,44E+01	1,42E+00	2,29E-06
8,39E+04	6,22E-12	8,57E+05	-84,4	10,16	0,098	30000	9,84E-02	1,43E+01	1,41E+00	2,35E-06
8,10E+04	6,21E-12	8,31E+05	-84,4	10,21	0,098	31000	9,80E-02	1,43E+01	1,40E+00	2,41E-06
7,83E+04	6,2E-12	8,06E+05	-84,4	10,24	0,098	32000	9,76E-02	1,42E+01	1,39E+00	2,48E-06
7,58E+04	6,19E-12	7,83E+05	-84,5	10,28	0,097	33000	9,72E-02	1,42E+01	1,38E+00	2,54E-06
7,34E+04	6,18E-12	7,61E+05	-84,5	10,32	0,097	34000	9,69E-02	1,42E+01	1,38E+00	2,60E-06
7,12E+04	6,17E-12	7,40E+05	-84,5	10,35	0,097	35000	9,66E-02	1,42E+01	1,37E+00	2,67E-06
6,91E+04	6,16E-12	7,21E+05	-84,5	10,38	0,096	36000	9,63E-02	1,41E+01	1,36E+00	2,73E-06
6,72E+04	6,15E-12	7,02E+05	-84,5	10,41	0,096	37000	9,61E-02	1,41E+01	1,36E+00	2,79E-06
6,54E+04	6,15E-12	6,85E+05	-84,5	10,42	0,096	38000	9,59E-02	1,41E+01	1,36E+00	2,87E-06
6,37E+04	6,14E-12	6,68E+05	-84,5	10,43	0,096	39000	9,59E-02	1,41E+01	1,35E+00	2,93E-06
6,21E+04	6,13E-12	6,52E+05	-84,5	10,45	0,096	40000	9,57E-02	1,41E+01	1,35E+00	3,00E-06
5,82E+04	6,11E-12	6,16E+05	-84,6	10,52	0,095	42500	9,50E-02	1,40E+01	1,33E+00	3,15E-06
5,49E+04	6,1E-12	5,83E+05	-84,6	10,57	0,095	45000	9,46E-02	1,40E+01	1,33E+00	3,32E-06
5,17E+04	6,08E-12	5,54E+05	-84,6	10,66	0,094	47500	9,38E-02	1,40E+01	1,31E+00	3,46E-06
4,90E+04	6,06E-12	5,27E+05	-84,7	10,7	0,093	50000	9,34E-02	1,39E+01	1,30E+00	3,61E-06
4,66E+04	6,05E-12	5,03E+05	-84,7	10,76	0,093	52500	9,29E-02	1,39E+01	1,29E+00	3,77E-06
4,44E+04	6,04E-12	4,82E+05	-84,7	10,81	0,093	55000	9,25E-02	1,39E+01	1,28E+00	3,93E-06
4,23E+04	6,02E-12	4,62E+05	-84,7	10,87	0,092	57500	9,20E-02	1,38E+01	1,27E+00	4,07E-06
4,04E+04	6,01E-12	4,43E+05	-84,8	10,92	0,092	60000	9,15E-02	1,38E+01	1,26E+00	4,22E-06

3. CONCLUSION

We achieve better physical – mechanical properties and adhesion towards textile cord for both modified rubber mixtures. Following properties improvement is in consequence of chemicals feeding change, especially NBR caoutchouc and silica feeding. Electrical properties were compared – rubber blend 2 has better properties than blend 1. All measured and calculated parameters are dependent on chemical composition of rubber recipe. Also we can tell that we find out the new useful recipes which have a good influence on present properties.

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