Electronic Supplementary Information

1. Schematic representation for the preparation of the FM nanocomposites

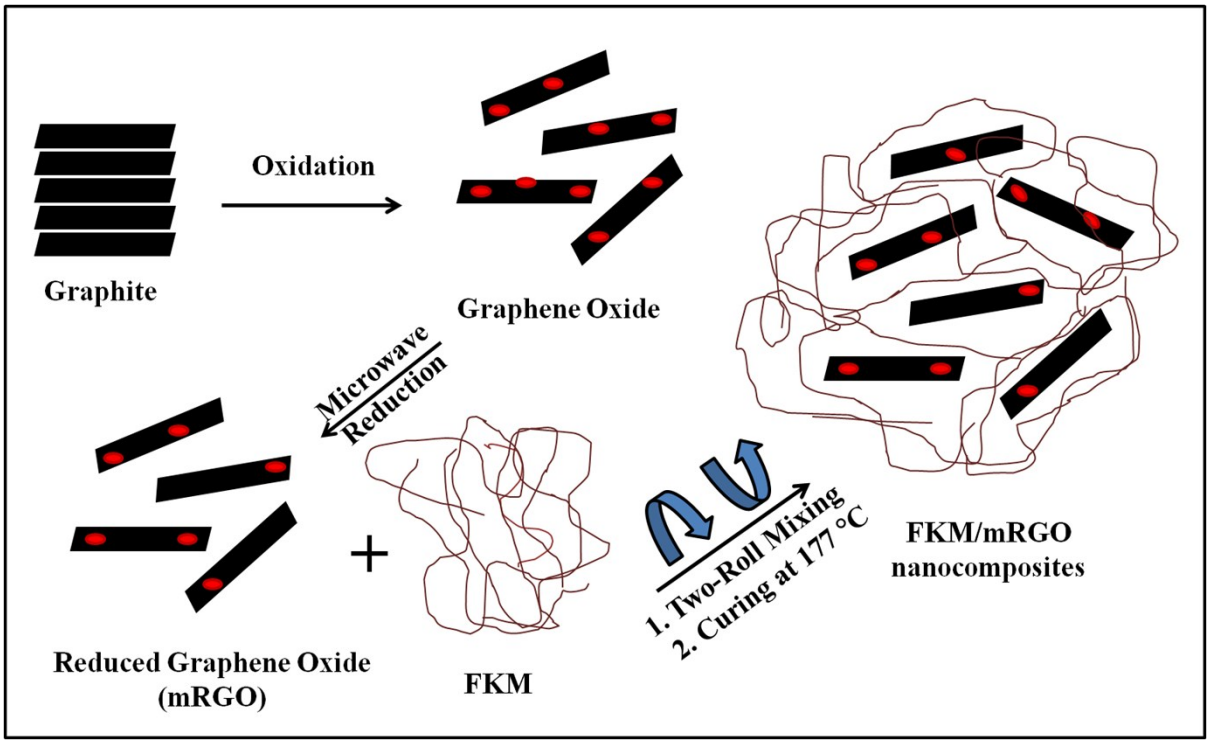

Figure S1. Schematic representation for the preparation of FM nanocomposites

2. Description of the solvents and FKM used for the diffusion study

Table S1. Detailed description of the materials used for diffusion study.

Materials used	Molecular Weight (g mol^{-1})	Density (g cm^{-3})	Molar Volume (mol cm^{-3})	Boiling Point (°C)	Solubility Parameter (MPa$^{1/2}$)	Dipole Moment (D)
Benzene	78.11	0.874	89.3707	79	18.7	0
Toluene	92.14	0.867	106.6435	109	18.3	0.36
Xylene	106.17	0.860	123.4534	137	18.2	0.70
FKM		1.82			14.4	

3. Swelling Studies

The parameters such as swelling index and swelling coefficient were analyzed to study about the swelling properties of FM nanocomposites. The swelling studies provide information on the interface strength, degree of dispersion of the filler and their alignment in the elastomer matrix. Moreover it provides an idea about the interfacial interaction between the filler and the polymer matrix.

The swelling coefficient is an index of the ability with which the sample swells[i] and is given by the equation,

$$\text{Swelling Coefficent, } \alpha = \left[\frac{A_s}{m}\right] \times \left(\frac{1}{\rho_s}\right) \quad (1)$$

where A_s is the weight of solvent sorbed at equilibrium swelling, m is the mass of the sample before swelling and ρ_s is the density of solvent used. The parameter, swelling index is given by the equation

$$\text{Swelling Index} = \left[(W_2 - W_1)/W_1\right] \times 100 \quad (2)$$

where W_1 and W_2 are the initial and final (swollen) weights of the sample. The values of swelling index and swelling coefficient obtained for the FM nanocomposites with filler loading are given in Table S2.

Table S2. Swelling parameters of the FM nanocomposites with filler loading

Solvent	Sample	Swelling Coefficient	Swelling Index %
Benzene	FM 0	0.188	16.56
	FM 0.25	0.171	15.01
	FM 0.75	0.168	14.76
	FM 1.25	0.163	14.39
	FM 2	0.167	14.68
Toluene	FM 0	0.151	13.07
	FM 0.25	0.149	12.95
	FM 0.75	0.149	12.91
	FM 1.25	0.147	12.72
	FM 2	0.144	12.46
Xylene	FM 0	0.077	6.171
	FM 0.25	0.064	5.474
	FM 0.75	0.063	5.371
	FM 1.25	0.055	4.729
	FM 2	0.067	5.575

The value for both parameters decreases with increase in filler loading up to 1.25 phr of filler loading. This is because as the filler loading increases the path for the penetrant molecules to pass through the nanocomposite decreases due to the hindrance produced by the filler material. Also the sorption behaviour depends upon the penetrant size and molar volume. As the penetrant size increases value of both swelling coefficient and swelling index decreases dramatically. Here molar volume increases in the order benzene < toluene < xylene and as the molar volume increases the ability of the penetrant molecules to permeate through the matrix becomes difficult and hence the parameters show a decrease in the corresponding values.

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[i]Lovely Mathew, K. U. Joseph, Rani Joseph, Swelling behaviour of isora/natural rubber composites in oils used in automobiles, Bull. Mater. Sci., Vol. 29, No. 1, February 2006, pp. 91-99.