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Rubber Elasticity for percolation network consisting of Gaussian Chains KENGO NISHI, Georg-August-Universitt Gttingen, MITSUHIRO SHIBAYAMA, TAKAMASA SAKAI, The University of Tokyo — A theory describing the elastic modulus for percolation networks of Gaussian chains on general lattices such as square and cubic lattices is proposed and its validity is examined with simulation and mechanical experiments on well-defined polymer networks. The theory was developed by generalizing the effective medium approximation for Hookian spring network (EMA) to Gaussian chain networks. From EMA theory, we found that the ratio of the elastic modulus at p,G to that at $p = 1$,G_0, must be equal to$G/G_0 = (p - 2/f)/(1 - 2/f)$if the position of sites can be determined so as to meet the force balance, where$p$ is the degree of cross-linking reaction. However, the EMA prediction cannot be applicable near its percolation threshold because EMA is a mean field theory. Thus, we combine real-space renormalization and EMA, and propose a theory called real-space renormalized EMA, i.e., REMA. The elastic modulus predicted by REMA is in excellent agreement with the results of simulations and experiments of near-ideal diamond lattice gels.

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