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The effect of topology on the conformations of cyclic polymers in melts MICHAEL LANG, JAKOB FISCHER, JENS-UWE SOMMER, Leibniz Institut für Polymerforschung Dresden, Hohe Straße 6, 01069 Dresden, Germany, THEORIE DER POLYMERE TEAM — The bond fluctuation method is used to simulate both non-concatenated entangled and interpenetrating melts of cyclic polymers. We find that the swelling of interpenetrating rings upon dilution follows the same laws as for linear chains. The knotting probability of cyclic polymers decays exponentially as function of the number of blobs per chain. A power law dependence $f_n \sim \phi R^2 \sim \phi^{0.77} N$ for the average number f_n of linked rings per cyclic polymer at concentrations larger than the overlap volume fraction of rings ϕ^* is determined from the simulation data. The fraction of non-concatenated cyclic polymers displays an exponential decay $P_{OO} \sim \exp(-f_n)$, which indicates f_n to provide the entropic effort for not forming concatenated conformations. These results lead to four different regimes for the conformations of cyclic polymers in melts separated by critical lengths N_{OO} , N_C and N^* that describe the onset of concatenation, the cross-over between weak and strong compression, and the cross-over to an overlap dominated concatenation contribution. The four characteristic exponents describing ring size in these regimes are $1/2$, $2/5$, $3/8$, and $4/9$ as confirmed by simulation data for the first three regimes.

Michael Lang
Leibniz Institut für Polymerforschung Dresden,
Hohe Straße 6, 01069 Dresden, Germany

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