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Sol-gel transition is one of phenomena classified to percolation transition. Percolation has been extensively investigated in 1970s – 1990s both experimentally and theoretically. By tuning the concentrations and ratio of monomers and crosslinkers, one can synthesize various critical clusters on the verge of percolation. However, most of the previous studies only focused on one critical conditions (one monomer concentration and one crosslinker ratio). Recently, we succeeded in preparation of critical polymer clusters by cross-end-coupling multi-arm prepolymers, which shows less side-reactions and generates critical polymer clusters with good reproducibility. In this presentation, we revisit this old problem by using well-tuned polymer network clusters at various critical conditions, discuss the structure of critical polymer clusters, and demonstrate some applications.