Fabrication of the diamond structure by self-assembly is a fundamental challenge in making three-dimensional photonic crystals. In this study we perform molecular simulations of model hard particles with patches of attractive interactions and show that particles with these interactions can self-assemble into a diamond structure from an initially disordered state. We show that the formation of the diamond structure can be facilitated by “seeding” the system with small diamond crystallites or by introducing a rotation-inducing interaction to mimic a carbon-carbon bond rotation. Our results suggest the patchy particles may serve as colloidal “atoms” for the bottom-up self-assembly of three-dimensional photonic crystals.