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Self-Assembled Superparamagnetic Binary Nanoparticle Superlattices[1] J. CHEN, Dept Mat Sci & Engn, Univ Penn, X. YE, Dept Chem, Univ Penn, Y. ZHANG, Dept Mat Sci & Engn, Univ Penn, J.M. KIKKAWA, Dept Phys & Astron, Univ Penn, C.B. MURRAY, Dept Mat Sci & Engn, Dept Chem, Univ Penn — We report binary nanoparticle superlattices (BNSLs) composed of two different types of superparamagnetic nanoparticles (NPs). Since the magnetic properties of these NPs depend both on size and composition, two strategies are used to form BNSLs. First, we use different sizes of the same material (e.g.-10.5 nm and 5.6 nm diameter Fe_3O_4 NPs). Second, we use different materials, such as 14.2 nm Fe_3O_4 NPs and 6 nm FePt NPs, or 14.2 nm Fe_3O_4 NPs and 7.1 nm $CoPt_3$ NPs. We observe the formation of large scale BNSLs (up to several μm) due to the high uniformity of these nanoparticles. Using a serial tilting capability of our TEM tomography holder we confirm that the BNSLs are icosohedral $NaZn_{13}$ and AlB_2 type structures, which are thermodynamically stable due to their high packing density. We further measured the magnetic properties of these BNSLs samples, and single component samples, by SQUID magnetometry. Dipolar and/or exchange coupling between two components is studied.

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