Water treatment and water desalination require membranes that are highly selective and allow for a high flux with a sufficient chemical and physical resistance. We aim to develop novel inorganic membranes by the self-assembly of nano-porous, hollow cubic colloids into a densely packed array on a substrate. The hollow cubic colloids are prepared from template cubic hematite ($\alpha$-Fe$_2$O$_3$) colloids coated with silica (Figure 1) [1]. Particle size control is obtained through a detailed study of the gel-sol based synthesis of the cubic hematite colloids. The synthesis involves the aging of highly condensed iron hydroxide at elevated temperatures. The size of the cubic colloids can be tuned between 500 nm and 1500 nm by variation in both the excess Fe$^{3+}$ concentration and the addition speed of the reactants. Size control of the template cubic colloids is not only fundamentally interesting, but together with the possibility of varying the thickness of the silica coating, allows us to tune the properties of the membranes.

Figure 1: A) Template hematite cubic colloids. B) Hematite cubic colloids coated with silica. C) Hollow silica cubic colloids.

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