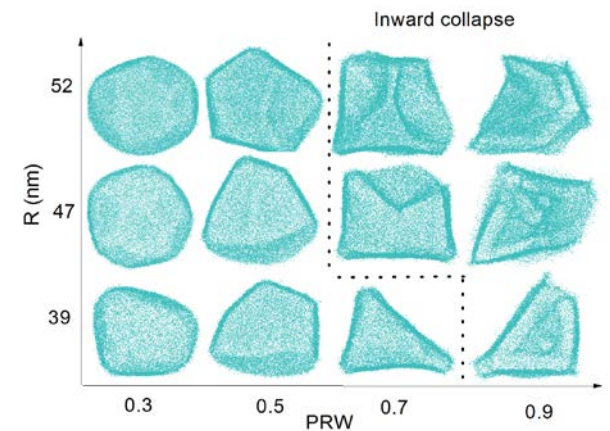


# Vesicle Geometries Enabled by Dynamically Trapped States

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Understanding and controlling vesicle shapes is a fundamental challenge in biophysics and materials design. Herein, we design dynamic protocols for enlarging the shape space of both fluid and crystalline vesicles beyond the equilibrium zone. By removing water from within the vesicle at different rates, we numerically produced a series of dynamically trapped stable vesicle shapes for both fluid and crystalline vesicles in a highly controllable fashion. In crystalline vesicles that are continuously dehydrated, simulations show the initial appearance of small flat areas over the surface of the vesicles that ultimately merge to form fewer flat faces. In this way, the vesicles transform from a fullerene-like shape into various faceted polyhedrons. We perform analytical elasticity analysis to show that these salient features are attributable to the crystalline nature of the vesicle. The potential to use dynamic protocols, such as those used in this study, to engineer vesicle shape transformations are helpful for exploiting the richness of vesicle geometries for desired applications.



*Figure. Shape evolution of crystalline vesicles with different sizes under protocol M. The deformation of the vesicles follows a pattern with the increase of the percentage of removed water (PRW)*