

# Mechanical Engineering Thesis Defense

Thermal Transport in Cadmium Sulfide Nanocrystals and Magic-sized Clusters

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## Abstract

We investigate the thermal conductivity of cadmium sulfide (CdS) magic-sized clusters (MSCs) and colloidal nanocrystals. It is well documented in the literature that the thermal conductivity of colloidal nanocrystal assemblies decreases as diameter decreases. We observe that the extrapolation of this size dependence does not apply to magic-sized clusters. Magic-sized clusters have an anomalously high thermal conductivity relative to the extrapolated size-dependence trend line for the colloidal nanocrystals. We hypothesize that this anomalously high thermal conductivity is due to the monodispersity of magic-sized clusters. To support this conjecture, we deliberately eliminate the monodispersity of MSCs by mixing them with colloidal nanocrystals. We find that mixtures of nanocrystals and MSCs have a lower thermal conductivity that falls approximately on the extrapolated trendline for colloidal nanocrystal thermal conductivity as a function of size.



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