# Solution Processing of Vertically Aligned Polymer Nanotubes for Thermal Interface and Multi-functional Applications

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## Abstract

The performance of many electronic devices (microprocessors, solar cells...etc.) is limited by high operating temperatures. Advanced thermal interface materials (TIMs) are needed to improve current systems and to satisfy the thermal management requirements of future technologies. Ideal TIMs exhibit high thermal conductivity and maintain mechanical compliance despite extreme operating conditions. “Soft” polymeric materials that can withstand thermal degradation are ideal candidates for mechanical compliance; however, bulk polymers exhibit phonon scattering and are poor conductors of thermal energy. On the other hand, polymer nanofibers have demonstrated superior thermal conductivity. The focus of this work is to produce and test vertically aligned and high aspect ratio conjugated polymer nanotube TIMs. These structures have been synthesized by infiltrating nanoporous templates with conjugated polymer solutions. This simple, solution based processing technique allows for synthesis at ambient conditions and is particularly fast when compared to other fabrication methods. The thermal and mechanical properties (durability) of the fabricated polymer nanotube arrays were examined to determine their suitability for said applications. Additionally, there is intense interest in high aspect ratio conjugated systems for use in nanodevices due to their electronic conductivity. This manufacturing method would be useful for researches to further explore the multi-functionality of nanopolymeric materials.