

High Thermal Conductivity Switch-on Behavior in Graphene Paper

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We report on the discovery of a high thermal conductivity (κ) switch-on phenomenon in high purity graphene paper (GP) when its temperature is reduced from room temperature down to 10 K. The κ after switch-on (1732 to 3013 W m⁻¹ K⁻¹) is 4–8 times that before switch-on. The triggering temperature is 245–260 K. The switch-on behavior is attributed to the thermal expansion mismatch between pure graphene flakes and impurity-embedded flakes. This is confirmed by the switch behavior of the temperature coefficient of resistance. Before switch-on, the interactions between pure graphene flakes and surrounding impurity-embedded flakes efficiently suppress phonon transport in GP. After switch-on, the structure separation frees the pure graphene flakes from the impurity-embedded neighbors, leading to several-fold κ increase. This finding points out a novel way to switch on/off the thermal conductivity of graphene paper based on substrate-phonon scattering.