GRADUATE STUDENT RESEARCH SEMINAR SERIES (2021)

DYNAMIC IMPACT RESISTANCE OF NACRE-INSPIRED MULTI-LAYER GRAPHENE-POLYMER NANOCOMPOSITES

SPEAKER: JONATHON CHIANG

Nacre, a brick-and-mortar type of layered structure, has been shown to optimize both strength and toughness along the layer direction. However, such natural materials are more often experiencing impact load in the direction perpendicular to the layers from a sea of predators. The dynamic response of layered structures under impact load has been much less studied. A fundamental understanding of the dynamic mechanical behavior of nacre-inspired layered nanocomposites seeds an effort towards effective design strategy of impact-resistant films. This study investigates the dynamic mechanical behaviors of layered nanocomposites by using multilayer graphene (MLG)-polymer nanocomposite as model systems. With a validated coarse-grained molecular dynamics (CGMD) simulation approach, we systematically study the mechanical properties and impact resistance of the MLG-PMMA nanocomposites with different nanostructures represented by the layer thickness and number of repetitions while keeping the total volume constant. When the thickness of the polymer layers confined by the adjacent MLG phases decrease, the effective modulus of the polymer phase increases. This is due to the nanoconfinement effect on the polymer phase, and the result is consistent with recent experimental and computational studies. By using high velocity impact simulations, we find that the impact resistance of the system is tailored by internal nanostructures.

MONDAY, MARCH 1 3:00 PM

EIB 132