Graphene Reinforced Aluminum Alloy Composite Foam: Response to High Strain Rate Deformation

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ABSTRACT

Aluminum foams are becoming potential material for multifunctional applications because it is lightweight and has excellent combination of physical and mechanical properties and noise and vibration mitigation characteristic. Because of its cellular structure, it exhibits excellent damping capacity, sound and noise absorption, shock and impact energy absorption. Applications of metal foam for energy absorption and crashworthiness require knowledge on their compressive deformation response at various strain rates. The properties of metal foam are dependent on cell wall mechanical properties and their microstructure. Cell wall properties have been improving by adding Graphene Nano platelets as reinforcement to the Al-foam. This investigation is related to the study of quasi-static compressive behavior and the high strain rate response under dynamic compressive loading in Graphene Al foam. The experimental results show that the peak, plateau stress and energy absorption of reinforced foam is much higher than unreinforced foam. The high strain rate compressive behavior of Graphene Al foam been studied using the split Hopkinson pressure bar apparatus. It is found that peak stress, plateau stress and energy absorption of Graphene Al foam increases as the strain rate increases over a range of strain rate from 500 s\(^{-1}\) to 2760 s\(^{-1}\). Thus, the Graphene Al foam is strain rate sensitive the plateau stress and energy absorption in the Graphene -Al foam increased by about two times and three times, respectively, compared to unreinforced foam.