Crack Petterns in Composites: The Fracture Percolation Threshold

Abstract

When two or more different materials are combined to form composites. We study crack formation in composites through a very general spring network model on a square lattice. The spring model shows the distortion of the lattice, prior to fracture and this affects the pattern of subsequent cracks. Two different types of sites (A and B) are distributed randomly on the lattice, representing two different constituents. There are springs of three types connecting them (AA, BB and AB). We assign two spring parameters for each type of spring. These are a spring constant and a breaking threshold. We show that intermediate compositions may require higher energy to induce the first sample spanning break than either pure A or pure B. So the breaking energy goes through a maximum as the concentration of one component varies from 0to 100%. The position and height of the peak depend on the spring parameters.