

Controlling Cracks in Multiscale Inorganic Structures

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In materials science, different types of materials have their own characteristic defects under both internal and external stresses. For example, soft materials are deformed under stresses while brittle materials become cracked. These defects must be avoided to make final products more complete and durable. Nevertheless, there recently have been some efforts to exploit deformations of soft materials in various applications including microfluidic and energy harvesting devices and gratings for displays. Cracks induced in inorganic materials, on the other hand, still have huge room to be utilized for such applications and are expected to be more effective due to their higher aspect ratio, only if successfully controlled because crack formation is a highly irreversible and random process representing daunting challenge. In this work, we propose a novel and smart method to control cracks in microstructures consisting of inorganic nanoparticles. By effectively concentrating tensile stresses with relevant patterning technique, we could induce cracks at desired locations, and the cracking mechanism and control parameters will be discussed in detail.