The effect of pulverization methods on the microstructure of carbon aerogels

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Carbon aerogels find application in many fields. In most of the applications, they are used as powders and thus need to be pulverized. However, the pulverization could induce various changes in the microstructure of carbon aerogels. The extent of changes depends not only on the dominant forces of used technique, but also on the mechanical and structural properties of initial monolithic samples.

To produce carbon aerogels in a powdered form, the monolithic sample can easily be grinded manually using sand paper. The accruing powder is then collected from the surface and can be used for any application. During grinding, only low forces are applied to the sample which makes the method applicable for fragile or soft materials. Among the many milling techniques, shaker milling is based on frequent percussions of a steel or ceramic bar or balls inside of the milling container. Depending on frequency, the steel bar will oscillate in the container and through the powerful impacts, crush the sample. The shaker mills are often used under cryo temperatures, whereby the container is arranged in liquid nitrogen. Milling in a planetary ball mill is the most frequently used method to get carbon aerogel powder, where the monolithic aerogel is placed in a container with balls. In the present work, we discuss the influence of grinding, milling in shaker cryo mill and planetary ball mill on stiff, ductile and flexible carbon aerogels. Results show that stiff carbon aerogels do not undergo noticeable changes. In contrast, ductile carbon aerogels are very sensitive to friction forces. Soft and flexible carbon aerogels undergo drastic changes in the microstructure.