Project description for the Marie-Curie Program "Biomimetic Materials"

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Friction and wear on biological and biomimetic materials

Friction and wear of biological and biomimetic materials as well as of materials derived from biological materials are of great practical importance. Examples include the masticatory tools (teeth, mandibles etc) of various animals, hoofs, and wood as well as wood modified by impregnation. The topic of the investigation is therefore friction and wear of such materials on the nano- and micrometer scale and its connection with other mechanical properties such as hardness and elastic constants. Especially for biological materials the experiments have to be done under conditions close to "in vivo", i.e. under a buffer solution mimicking the respective body fluid the material is exposed to in vivo. A comparison with technical materials, e.g. polymers, is planned in order to throw light on the role of biological reinforcement mechanisms like, e.g., the inclusion of mineral crystals into an organic matrix. The primary investigation methods are AFM and nanoindenter.

Biomimetic Metal Foams

Recently an Austrian Company tried a new way of producing metal foams, i.e. by sintering together monodisperse hollow spheres. Within the new project and in collaboration with that company we want to explore yet another route: sintering together elongated hollow cells (capped tubes) thus mimicking the cell structure of wood. The aim of the project is to investigate the necessarily anisotropic mechanical properties of such metal foams while varying parameters like the apparent density, the aspect ratio (length-to-diameter ratio) and the connectivity of the "cells" etc. To this purpose conventional mechanical tests shall be applied as well as fracture mechanics and a detailed investigation of the mechanical behavior of individual cells within the composite. A numerical simulation of the behavior of the material would be desirable.