The strength of nanosize objects increases with decreasing size and can approximate the theoretical shear strength. We use dealloying for creating nanoporous materials that are networks of metallic nanoscale "ligaments". These materials can be made with macroscopic dimensions and can, in principle, be shaped into engineering components comprising in the order of $10^{14}$ ligaments per mm$^3$.

Nanoporous metals also offer new opportunities for materials design towards functionality. Throughout the pore space, the state of the metal surface can be reversibly modulated under control of electrical or chemical signals. This affords changes of the capillary forces and of the optical or chemical properties in the interfacial regions, strongly affecting the effective macroscopic materials behavior. So far we have addressed size-dependent strength and elasticity, the impact of the surfaces for the mechanical behavior, and the role of the network topology. In the second funding period we aim to demonstrate materials that simultaneously bring interesting mechanical behavior and novel functionality. As one instance, we have shown that nanoporous gold-based hybrid nanomaterials can exhibit an effective piezoelectric response. This is remarkable since piezoelectricity is classically restricted to ceramics.

**Similar to piezoelectric solids, hybrid materials of nanoporous gold and water create robust electric signals when strained by an external load [2].**

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**Publications**

... and more on the [list of publications](#).