MECHANICAL PROPERTIES OF FIVEFOLD TWINNED NANOWIRES AFFECTED BY STRUCTURE INDUCED INTERNAL STRESSES

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The fivefold symmetry is very common for FCC metal nanoparticles and nanowires (NWs) e.g., gold (Au) and silver (Ag). The pentagonal NW is conditioned by twin boundaries dividing five regular crystalline domains [1,2]. This peculiar structure leads to the presence of inner stresses [2], which can have a considerable influence on the NWs mechanical behaviour. This fact must be taken into account when considering applications in which nanocrystals are subjected to mechanical deformation, like e.g. NW-based nanoswitches [3] and waveguides for visible light [4,5].

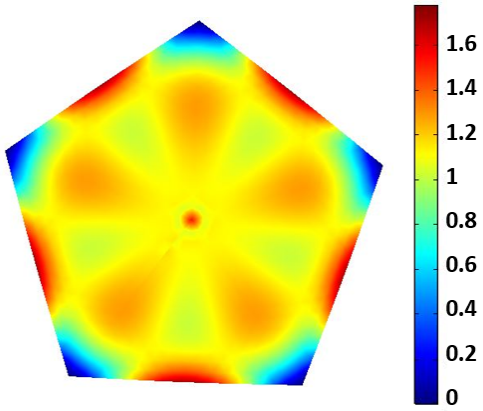

Fig.1 Von Mises stresses (GPa) in Ag NW cross-section.

In the present work pentagonal Ag and Au NWs were modelled and their mechanical response simulated using finite element method. The model considered the fivefold twinned structure and the inner stresses (Fig.1) caused by it. The cantilevered beam bending test was simulated to further understand the influence of Ag and Au NWs structure on their mechanical behaviour.

References

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