Ageing of silver fractals nanostructures induced by atmospheric corrosion

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Metal nanostructures have been proposed for many applications in nanomaterials, nanoelectronics etc., however there is a lack of information about the stability of those nanostructures against time. Furthermore, silver nanostructures have been attracting more and more attention because of their interesting electrical, thermal, optical and reactive properties. In that respect it is of fundamental interest to know how does a nanostructure resist to ageing. Although atmospheric corrosion in metals is a common phenomenon, little is known about corrosion at nanometer scale.

The fragmentation mechanisms induced by atmospheric corrosion are studied on silver nano-fractal objects obtained from physical method. Those nano-fractals formed by deposition and diffusion of silver clusters on cleaved graphite surfaces exhibit dendritic morphologies that are highly sensitive to any perturbation. After ageing by exposure to the ambient air, these structures reveal two competitive fragmentation mechanisms due to chlorine and sulphur pollution as the main agents for fractal degradation.

One is similar to that of the bulk silver and nanostructures obtained using chemical method, the other one is similar to Rayleigh like instabilities. Complementary experiments where the samples are exposed either to saturated chlorine or sulphur environment allow us to disentangle the dynamics of the two fragmentation mechanisms. High resolution TEM and EELS spectroscopy complete characterization of corrosion mechanisms.