

Accelerating test to assess metal release to the environment from nanowire transparent conducting films

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The increasing worldwide use of rare metals, including precious metals and critical metals, has an impact on the geochemical cycles of these elements. At all stages of a product life, these metals and their compounds can be released into the environment and come in contact with the biosphere. The use of rare metals in nanomaterials used in high-tech products can have particular issues for environmental impact because of the potentially colloidal nature of these materials implying mobility, high surface reactivity and increased solubility .

We are focusing on silver nanowires (AgNW). These materials are designed to be incorporated in transparent conductive films, in electronics, microelectrodes, heated surfaces, etc. Although they are commonly protected by a coating material, there is a risk for release of dissolved or nanoparticulate compounds either during use or after disposal at end-of-life, because of some degree of permeability of the protective material either at molecular level or because of mechanical or chemical degradation. Since ionic and nanoparticulate Ag is toxic to the biosphere, there is a need for quantifying potential release from these product components .

We developed a method to evaluate the corrosion activity of silver in nanowire transparent conductive films under aqueous environmental conditions. In this method, the corrosion current response obtained from AgNW coated films is quantified. It is shown that there is a consistent link between the current and the coatings' characteristics. The advantage of this approach compared to classical aging studies resides in its much higher speed, 10-20 minutes are sufficient for a diagnostic result. The method is thus seen as an accelerated corrosion test.

We surmise that the method could be easily adapted to conducting films containing speciality elements, in particular the TCEs.