229d Engineering the Properties of Nanowires by Means of Surface Modifications [Invited]
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Nanowires, as well as other geometries of nanomaterials, have been touted as the road to future technologies. However, there are significant roadblocks to the realization of viable nanowire based technologies, specifically, placement of individual nanowires in a repeatable and economic fashion. In the case of chemical sensors a mess of nanowires should get the job done. However, simply taking a mesh of nanowires and constructing a sensor will not guarantee a species discriminating sensing. Two novel approaches are presented for modifying the surface nanowires in order to tailor their surface properties for different sensing applications. The enhanced reactivity of the metallic nanoparticles provided sensitivity and selectivity and therefore are ideal for integration with nanowires into a chemical sensor. The decoration of a mesh of nanowires with metallic nanoparticles increases the surface area relative to a plane of metal nanoparticles by up to three orders of magnitude. The results of a study utilizing the technique of plasma enhanced chemical vapor deposition (PECVD) for coating nanowires with narrow size distributions of Ni, Pt and Au nanoparticles will be presented. The mechanism for nanoparticles formation will be explored, as well as the versatility of the process for coating nanowires of different materials. In some applications an oxide may have more suitable properties from the standpoint of sensing. However, an oxide nanowire may not have suitable electrical properties. Consequently, a semiconducting nanowire would be a better choice from the standpoint of electrical measurements. The results of a study using atomic layer deposition for growing oxide layers on nanowires will also be discussed. The ability to uniformly coat nanowires with oxide layers provides an additional level of versatility for tailoring the properties of the surfaces of nanowires for sensor applications.