A Novel Strategy of Surface Nanofication for Ceramic Gas Sensors
(Invited)

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High selectivity, enhanced sensitivity, short response time and long shelf-life are some of the key features sought in the solid-state ceramic-based chemical sensors. Since the sensing mechanism and catalytic activity of ceramics are predominantly surface-dominated, benign surface features in terms of small grain size, large surface area and, open and connected porosity, are required to realize a successful material.

In the case of oxide ceramics, we have developed a technique based on rigorous thermodynamic consideration of the metal/metal oxide coexistence. In order to incorporate the required nanoscale morphological features, a gas phase redox scheme was adopted. By modulating the oxygen particle pressure below or above the theoretical metal oxide/metal coexistence line, the formation and growth of new oxide surface on an atomic/molecular level, under conditions of ‘oxygen starvation’ was achieved and, novel microstructures in a host of oxide systems were incorporated. The presentation will discuss the methodology and the results obtained in the case of some oxide systems wherein by imparting these benign surface features, their gas sensing functions were greatly accentuated.