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Abstract

From Single Nanowires to Smart Systems: Different Ways to Assess Food Quality †

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Abstract: Recently, low-dimensional (1D, 2D) nanostructured materials are attracting more and more interest as building blocks for innovative systems. Metal oxide nanowires are one of the most widely used materials for solid state gas sensors, as they are simple to make, inexpensive, and sensitive to a wide range of gases and volatiles. Unfortunately, their broad sensitivity has a price to pay: very low selectivity. Fortunately, this flaw is not a problem for all applications. Where the boundary conditions are defined and "simple", a simple chemiresistor may be the best choice, while in cases where the variables are many, it is better to use an intelligent system. In this paper we will show different systems based on metal oxide nanowires: single nanowire, many nanowires and on-chip systems, both traditional and smart. We will show that the performance of these nanostructures is excellent and can be used in various applications, including agri-food quality monitoring. We will demonstrate that the combination of different sensors of the same material positioned in a thermal gradient can act as an electronic nose, with excellent performance (100% classification and < 15% average error on gas concentration) thanks to machine learning algorithms. The integration of such tiny (less than one square mm) and cheap devices into the food supply chains would greatly reduce waste and the frequency of food poisoning.

Keywords: gas sensors; metal oxide; nanowire; electronic nose; machine learning