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Dodecane sensor based on perovskite $LaCoO_3$ nanowires: From material synthesis to electrical and gas sensing properties

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Recently considerable interest has been paid to n-dodecane ($C_{12}H_{26}$), as a possible alternative to petroleum-based jet fuel and other conventional aviation fuels [1]. Due to its flammable nature with lower explosive limit (*LEL*) of 0.6%, gas leaks represent considerable explosion hazards. The risk of severe accidents are not negligible in gas-and-oil industry, transportation and storage of gas & oil products and finally in the aircraft and military vehicles [2].

$LaCoO_3$ and its related materials exhibit interesting electrical and electrocatalytic properties. $LaCoO_3$ is p-type semiconductor and the presence of Co ions with different spin and oxidation states plays a crucial role for the transport properties and the catalytic activity [3]. Ag-substituted $LaCoO_3$ was investigated by Buchneva *et al.* [4] and it was found that the introduction of Ag in the structure of $LaCoO_3$ led to increasing catalytic activity.

In this paper, the synthesis of $La_xAg_yCoO_{3-\alpha}$ nanowires by reactive magnetron sputtering of metallic targets (∅ 200 mm) was explored. We investigated the morphology control of these materials by dosing silver content (Fig. 1a). Carrier concentration and mobility were studied to understand the change of electrical conductivity with the coating morphologies and compositions. Finally the performance of sensors based on $LaCoO_3$ nanowires was characterized under different concentrations of dodecane (Fig. 1b). The sensor response and recovery times are discussed as a function of sensor operating temperature and composition.

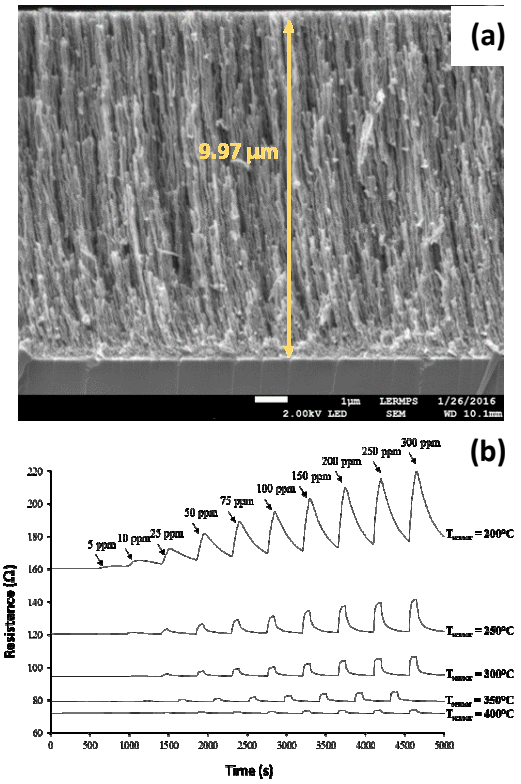

Fig. 1: a) cross-section observation & b) sensor resistance behaviors *vs.* time at different operating temperatures for perovskite nanowires produced by reactive magnetron sputtering.

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