Fabrication of an Indium tin oxide (ITO) alternative thin film with high transparency and conductivity for application in electronic devices.

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The study of highly transparent and conductive thin films for applications in displays, electronic technologies and energy devices has attracted great interest. However, trying to balance the transparency and conductivity can be rather challenging due to the two contradicting properties. For a material to be transparent in the visible region (400 nm – 800 nm) a wide band gap (E_g > 3 eV) is needed, which is generally associated with an overall lower conductivity. A material with high conductivity typically has a narrow band gap yielding a higher charge mobility and promotes a greater carrier concentration. Typical transparent conductive oxides (TCO's) achieve both its high visible transparency and conductivity by incorporating, wide band-gap oxides doped with materials which contains charge carriers in order to introduce some metallic behaviours. Tin doped indium oxide (ITO) has seen some adoption in electronic applications due to it wide transparency in the visible region > 85 %, its high electrical conductivity and carrier concentration in the order of 10^{-4} Ω cm and 10^{21} cm^{-3} respectively. However, indium is a relatively scarce resource making ITO films expensive to produce. It is therefore desirable to find a more cost-effective ITO alternative.

Strontium vanadate ($SrVO_3$) is known to have metallic properties and that the metallic properties are preserved in thin films. Early reports showed that $SrVO_3$ thin films with a thickness of 12 nm displayed a resistivity of 4.15 x 10^{-5} Ωm with a transparency of 80 % in the visible region. More importantly the cost of the raw materials was significantly cheaper than that used to produce ITO.

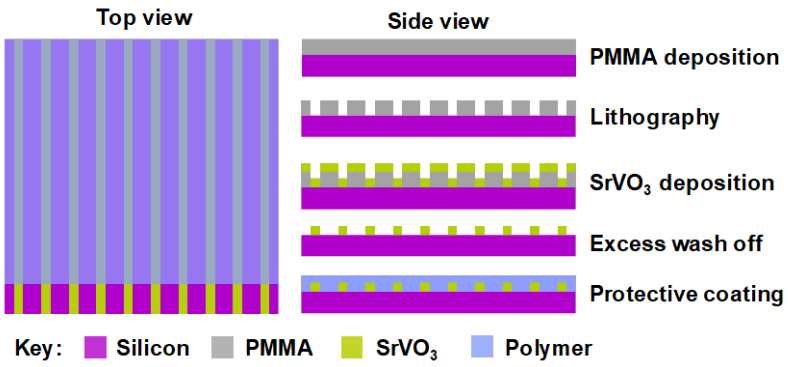

Figure 1: Step by step schematic for fabrication of transparent conductive $SrVO_3$ wires.