Proceedings of the Technical Session of Institute of Physics, Sri Lanka 17 (2001) 67-76

# Alteration of Electrical conduction properties of $TiO_2$ using $V_2O_3$, $V_2O_4$ and $Cr_2O_3$

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Effects of alteration of electrical conductivity properties of $TiO_2$ due to $V_2O_3$, $V_2O_4$ and $Cr_2O_3$ were studied. In all three cases the conductivity increased by several orders of magnitudes and the activation energy decreased significantly, depending on the dopant concentration.

The results obtained for $V_2O_3$, and $V_2O_4$ doping were approximately the same. The conductivity increased (by 6 orders up to $1.9 \acute{} 10^{-3} W^{-1} cm^{-1}$) and the activation energy decreased (by ~50% down to 0.39 eV). The highest conductivity and the lowest activation energy were measured at the same dopent concentration (11%). Approximately the same characteristics were seen when $TiO_2$ was doped with$Cr_2O_3$ however, the highest conductivity ( $1.7 \times 10^{-5}\ \Omega^{-1} cm^{-1}$) and the lowest activation energy (0.35 eV) were measured when the dopant concentration was about 6%. In all cases, the properties of doped samples depend significantly on the sintering temperature of the samples. The best results were obtained when the samples were sintered at 900 $^0$C.

The XRD analyses of the doped samples find an additional peak in chromium doped $TiO_2$ when sintered at 900 $^0$C indicating structural changes due to the incorporation of $Cr_2O_3$ . However, no structural changes were seen in XRD analyses of $V_2O_3$ or $V_2O_4$ doped samples. This indicates a significant difference between vanadium and chromium doped samples.