HIGH DENSED TIN DOPED INDIUM OXIDE CERAMICS FROM A HYDROTHEMALLY DERIVED POWDER

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Tin doped Indium oxide (ITO) has received much attention because of its desirable properties such as high conductivity (10^4 $\Omega^{-1}cm^{-1}$) and high transparency to visible light. Due to these characteristics, thin and thick films of ITO are used for several useful applications such as transparent electrodes for display devices and transparent coating for solar energy heat mirrors.

Among various processing methods, one of the best techniques to make the ITO films is magnetron sputtering, which utilizes either In-Sn alloy or In_2O_3-SnO_2 oxide as the sputtering target. The sputtering efficiency and properties of the sputtered films, strongly depend on the characteristics of the sputtering targets. The densification of ITO is usually accomplished by the conventional solid state reaction of oxides above 1600 °C, but it is difficult to obtain a dense and homogenous target due to poor densification of In_2O_3. In order to enhance the densification, either an oxidizing sintering atmosphere or sintering aids should be used. The aim of the present study was to fabricate additive free, compositionally homogeneous, dense ITO ceramics with air as the sintering atmosphere.

In the process, well-crystallized microcrystalline, homogeneous Sn-doped indium hydroxide [$In(OH)_3$:Sn] or Sn-doped indium oxyhydroxide [InOOH:Sn] powders were prepared by hydrothermally treating a co-precipitated indium-tin amorphous gel, which was formed from a mixed solution of tin and indium chlorides. Low temperature calcination (300-450°C) of the hydrothermally prepared powders form a cubic structured Sn doped In_2O_3 and a substitutional vacancy type solid solution of $In_2Sn_{1-x}O_{5-y}$ respectively. Sintering of both types of calcined powder compacts at 1350-1450°C for 3h in air resulting in high dense (>95% of theoretical density) C-type rare-earth oxide structured Sn-doped In_2O_3 ceramics with a fine grained microstructure and less pores. One of main advantages of this process is that the sintering was performed in air without sintering aids.