The Film property of super-cycled Al_2O_3/SnO_x atomic layer deposition and the associated thin film transistor performance

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Crystalized SnO_2 is known as superior transparent conducting oxide (TCO) which could be used in application such as displays, solar cells and sensors. It can be achieved to attain higher TCO performance by doping other groups and one of them is aluminum dopant. By controlling Al contents in SnO_x matrix, the physical and optical properties was easily manipulated in atomic layer deposited aluminum tin oxide (ATO) layers, which were used with tetrakis(dimethylamino)tin (TDMAT) as a Sn precursor, trimethylaluminum (TMA) as an Al precursor and hydrogen peroxide (H_2O_2 30%) as a reactant. As Al_2O_3 and SnO_x cycles are mixed with various super-cycles (Al_2O_3:SnO_x=n:m), the film properties were systematically changed in terms of the crystallinity, growth rate, and refractive index. The growth rate and refractive index were varied from 1.9 Å/cycle/2.05 to 1.1 Å/cycle/1.63, respectively. Interestingly, it suggested that the inserted TMA molecule or deposited Al2O3 layer affected to suppress initial growth significantly. The film crystallinity was changed from tetragonal SnOx to amorphous like ATO as the Al contents increased in SnOx matrix. Also, as modulating the syper-cycled Al2O3/SnOx layers, the electrical properties of ATO films can be controlled form conductor to semiconductor easily. Consequently, this presentation will show the suitable ATO semiconductor boundary and the associated thin film transistor performance.

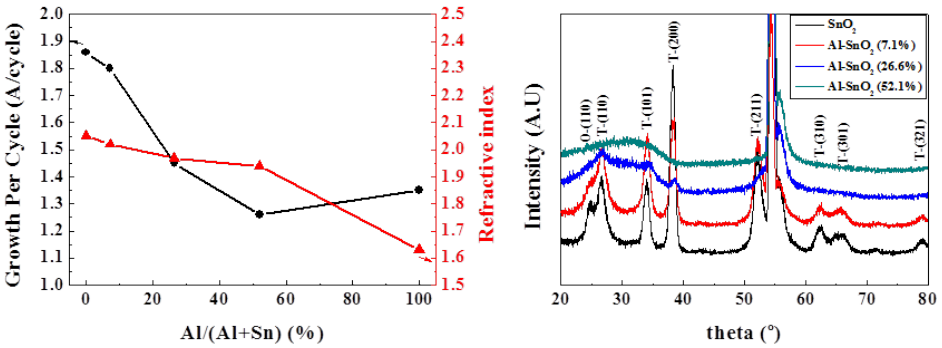

Fig. 1. Growth per cycle and refractive index of ATO by modulating aluminum content (left) XRD peak showing crystallinity of ATO