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Physical characterization and microstructure evaluation of titanium dioxide semiconductor discs processed with binders

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Abstract

The processing of TiO_2 semiconducting materials has a long route with numerous contributing variables. The binder plays an important role in the development of this electro-ceramic material. Higher density and strength of a green body are critical not only for handling at its green state but also to avoid the causes of flaw formation during sintering. Use of appropriate binder can lead to improve characteristics of powder which will reduce density gradient in the green body during compaction. Enhanced green properties can consequently lead to higher fired strength of the varistor discs. The binder system is anticipated to have an influence on the grain growth and microstructure which in turn affect the electrical performance. To investigate this phenomenon, TiO_2 powder doped with 0.2% of Ta_2O_5 was processed with and without binder polyvinyl alcohol. The prepared samples were characterized by evaluating the physical properties like green density, fired density, axial and radial shrinkage, micro hardness and compressive strength. It was observed that TiO_2 processed with binder exhibited better properties compared to powder processed without binder. The higher percent of binder enhanced the properties further. XRD revealed that the diffraction angle peak was similar to that of pure TiO_2. SEM analysis indicated that the average grain size was larger for discs prepared with higher percent of binder. It is anticipated that the larger grain size will improve varistor properties in terms of low voltage applications.

Biography

Shahida Begum, Associate Professor, in Mechanical Engineering at Universiti Tenaga Nasional (UNITEN), Malaysia. She had her BSc in Chemical Engineering from Bangladesh University of Engineering and Technology (BUET) and PhD in Mechanical and Manufacturing Engineering from Dublin City University, Ireland. She is involved in teaching of different courses in undergraduate and post graduate level and actively involved with research and published many papers in reputed journals. She also worked as a post graduate research fellow at Harris Corporation, Semiconductor Division, Ireland. She is the Head for Centre of Advanced Materials in the university.