

Electro-Thermo-Mechanical Behaviour of Functionally Graded Material Usage in Lead Acid Storage Batteries and the Benefits

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Abstract : Terminal post is one of the most important features of a Battery. The design and manufacturing of post are very much critical especially when threaded inserts (Bolt-on type) are used since all the collected energy is delivered from the lead part to the threaded insert (Cu or Cu alloy). Any imperfection at the interface may cause Voltage drop, high resistance, high heat generation, etc. This may be because of sudden change of material properties from lead to Cu alloys. To avoid this problem, a scheme of material gradation is proposed for achieving continuous variation of material properties for the Post used in commercially available lead acid battery. The Functionally graded (FG) material for the post is considered to be composed of different layers of homogeneous material. The volume fraction of the materials used corresponding to each layer is calculated by considering its variation along the direction of current flow (z) according to a power law. Accordingly, the effective properties of the homogeneous layers are estimated and the Post composed of this FG material is modeled using the commercially available ANSYS software. The solid 186 layered structural solid element has been used for discretization of the model of the FG Post. A thermal electric analysis is performed on the layered FG model. The model developed has been validated by comparing the results of the existing Post model& experimental analysis

Keywords : ANSYS, functionally graded material, lead-acid battery, terminal post

Conference Title : ICBFCT 2019 : International Conference on Battery and Fuel Cell Technology

Conference Location : Rome, Italy

Conference Dates : September 17-18, 2019