Lead Acid Batteries Separators : How and Why to manage Silica Hydrophilicity

Mohammed Abou Taha[1,2], R. Fulchiron[1], P. Cassagnau[1], V. Bounor-Legaré[1], M. Fumagalli[1], B. Schlegel[2], T. Chaussée[2], J. Valentes[2], A-L. Pinault[2]

Ingéniérie des Matériaux Polymères (IMP), CNRS UMR 5223, Université Lyon 1

Notwithstanding the growth of the new lithium-ion batteries market, lead-acid batteries still offer advantages that the new ones are not able to equate especially in terms of cost and manufacturing base. In this context, the aim of our work is to enhance the properties of lead-acid batteries PE-separators that predominate 90% of the lead-acid batteries separators market[1]. These porous membranes consist of precipitated silica, Ultra high molecular weight Polyethylene (UHMWPE) and process oil. Two types of porosities can be distinguished: Total porosity and electrolyte accessible porosity.

Our work focused on the enhancement of the electrolyte wettable porosity in order to enhance the electrical resistivity of the separator. The electrolyte wettability of the pores is not only related to the presence of silica in the pores but also to the type of silica surface. Paradoxically, less hydrophilic silica is important for the blend miscibility and dispersion, the oil retention and the recovery of the lost crystallinity of the UHMWPE[2]; while hydrophilic silica will promote the water accessibility as well as other polar solvents' accessibility such as sulfuric acid, the main electrolyte in the final application.

Therefore, silica surface underwent physical impregnation in order to obtain a battery separator material that is as homogeneous as possible with maximum water accessible porosity. Suspension rheology and other methods were used to sense the change of silica aggregates.

References:

[1] W. Böhnstedt, J. Polymer Sources 133 (2004) 59-66.
[2] F. Toquet, L. Guy, B. Schlegel, P. Cassagnau, R. Fulchiron, Polymer 97 (2016) 63-68.