Semi-empirical prediction of moisture build-up in an electronic enclosure using analysis of variance (ANOVA)

Electronic systems are exposed to harsh environmental conditions such as high humidity in many applications. Moisture transfer into electronic enclosures and condensation can cause several problems such as material degradation and corrosion. Therefore, it is important to control the moisture content and the relative humidity inside electronic enclosures. In this work, moisture transfer into a typical polycarbonate electronic enclosure with a cylindrical shape opening is studied. The effects of four influential parameters namely, initial relative humidity inside the enclosure, radius and length of the opening and temperature are studied. A set of experiments are done based on a fractional factorial design in order to estimate the time constant for moisture transfer into the enclosure by fitting the experimental data to an analytical quasi-steady-state model.

According to the statistical analysis, temperature and the opening length are found as the most significant factors. Based on analysis of variance of the derived time constants, a semi-empirical regression model is proposed to predict the moisture transfer time constant with an adjusted $R^2$ of 0.98; which demonstrated that the model can be used for estimation with a reasonable accuracy. The results show that the temperature has the highest effect on the moisture transfer time constant. Furthermore, the length of the opening is found to be more influential on the moisture transfer time constant at lower temperatures compared to high temperatures, according to the predictions made through the semi-empirical model.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Manufacturing Engineering
Number of pages: 6
Pages: 785-790
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 18th Electronics Packaging and Technology Conference (EPTC)
Publisher: IEEE
DOIs:
10.1109/EPTC.2016.7861588
Research output: Research - peer-review › Article in proceedings – Annual report year: 2017