Estimation of hygroscopic power of electrotechnical materials by dynamic speckle technique

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ABSTRACT

Dynamic speckle laser (DLS) technique has been applied to the analysis of different biological systems, inorganic materials and industrial processes. In this paper, we use this technique to analyze the hygroscopic properties of different types of porcelain and papers for electrotechnical purposes. Experimental speckle results showed different behavior depending on physicochemical and textural properties of the samples.

Keywords: Speckle; porous materials, electrotechnical materials, dielectric, insulating.

1. INTRODUCTION

Dynamic speckle patterns are generated by laser light scattering on surfaces that exhibit some kind of activity [1]. Is it a typical phenomenon observed when a laser light illuminate biological tissues [2], but it is also present in several industrial cases. Besides, the temporary evolution of speckle patterns, attributed to the presence of mobile scatters, is an interesting tool for characterization of mineral properties [3].
There are several basic materials that are found as part of electrical components such as electrotechnical porcelain and paper.
The porcelain is composed of a mixture of three alumino-silicates in a typical ratio: 50%, kaolin 25%, quartz and 25% feldspar. This porcelain has basic electrical, mechanical, thermal and porosity properties which naturally vary according to the composition of the mixture [4].
Electrotechnical paper is currently prepared from a mixture of cellulose pulp and varying amounts of filler such as clay, calcium sulfate, and inert mineral.
These materials are commonly used due to their insulating quality (Ex: Dielectric and insulation resistance) which basically depends on its porosity and hygroscopicity.
This work analyzes the level of water adsorption of different types of porcelain and papers for electrotechnical purposes, using the dynamic speckle laser technique. Additionally, adsorption tests by oil (commonly used as insulating of high voltage equipments) were carried out on paper.
Preliminary experimental results show the evolution of the speckle patterns during hydro or oil-adsorption process, allowing discriminating different properties of each material. It was determined that it is possible to correlate changes in the speckle patterns with the adsorption caused by the porosity of the materials.

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