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*Abstract*

# Dimensional variations on drying of composite components for abrasive wheels †

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Abrasive wheels are composed of abrasive grains, vitreous bond precursors and a temporary binder that, normally, includes a liquid part to give consistency and plasticity to the green body [1]. During the drying thermal cycle, there are length variations in the material caused by thermal expansion and water elimination. These can originate the formation of cracks in the composite. In this work, the effect of the amount of water added to the vitreous precursor and the organic additive (dextrin) was analyzed, up to 80 °C, by Thermomechanical Analysis and Dynamic Mechanical Analysis in compression mode. Firstly, it was observed that the vitreous bond precursor does not significantly contribute to the length variation of the composite (< 0.05%) in the drying process. Figure 1a presents the dimensional variation for dextrin with different $H_2O$ contents. Initially, the added water is incorporated into the dextrin molecules, as water of hydration (zone Z1). Sample with 7.0% $H_2O$ presents an expansion, up to ~47 °C, followed by a contraction. As the water content in the samples increases, free water begins to form and, therefore, the shrinkage generated by the water evaporation occurs (zone Z2) becoming the predominant effect. The trend lines of samples with water content in the range 22-30%, converge to a value of ~ 15 ± 1% of $H_2O$ as the transition zone to free water formation.

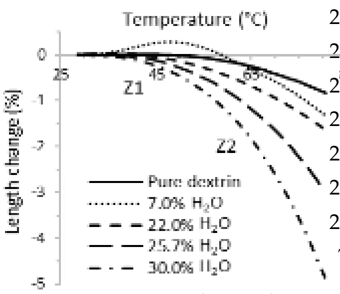


Figure 1 Dextrin thermal expansion

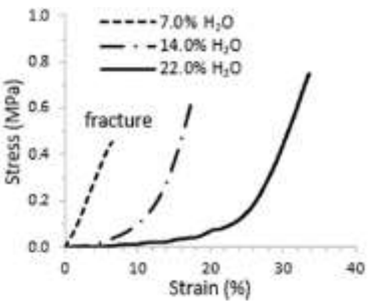


Figure 2 Dextrin compression tests

Compression tests (figure 1b) show that the two types of water incorporation in dextrin have a different effect: inducing a transition from a mainly elastic to a plastic deformation behavior. The necessary water content to guarantee the plasticity of the mixture without subjecting the composite to excessive dimensional variations during the drying step, was determined. Excess of water increases the global dimensional variation on drying and can induce formation of cracks.

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