



Desiccant Activation Testing White Paper



Slice Engineering®



Desiccant Activation Tests: Activated Alumina Versus Silica Gel

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Abstract—Moisture absorbed by 3D printing filament can cause a multitude of print quality issues. The Filament Drying Desiccant by Slice Engineering® presents a solution to removing humidity during filament storage. A desiccant is a hygroscopic material used to remove moisture from surrounding air to protect sensitive products. The most common desiccant is silica. Desiccant activation tests were conducted to observe and compare the moisture-adsorption of both silica gel and activated alumina. The change in relative humidity of the air within a vacuum-sealed container after 18 hours was utilized to determine the effectiveness of the desiccant. The tests were started at an approximate relative humidity of 43% and temperature of 23 °C. The lowest relative humidity reached by silica gel was 9.7% at the 17 hour mark. Activated alumina achieved a zero-percent relative humidity after 9.5 hours and maintained that level for the remainder of the experiment. The effectiveness of the two desiccants were determined to be 77.9% for silica gel and 100% for activated alumina. The data presented is used to determine how Slice Engineering's Filament Drying Desiccant behavior compares to an existing desiccant and whether it is a viable option for 3D printing filament storage.

Index Terms—Activated alumina, desiccant, relative humidity, silica

I. INTRODUCTION

A vital step to achieving a great quality print is drying filament. When printing with wet filament, it is likely to experience bubbles, extruder jams, poor adhesion, undesirable surface finishes, and more. All of these interfere with the success of a print. A potential solution is to dry the filament spools and properly store them in a sealed container

Relative humidity is defined as the amount of water vapor present in the air relative to the amount that would be present if the air were saturated [6]. The residual relative humidity of the air is one approach to measure the effectiveness of a desiccant.

Desiccant activation tests were conducted to observe and measure the drying behavior of two types of desiccant: silica gel and activated alumina. The change in relative humidity over a period of time was used to compare the ability of both desiccants to adsorb surrounding moisture. The tests aimed to achieve and maintain a zero-percent relative humidity in a vacuum-sealed environment. The characteristic differences were analyzed using the test results.

II. PROCEDURE

The adsorbing ability of each desiccant was explored through the following desiccant activation tests. These findings allowed for the comparison of the effectiveness of both types of desiccants.

A. Test Method

Two Slice Engineering Filament Drying Desiccant canisters were filled with an approximately equal volume of desiccant, one with silica gel beads and one with activated alumina spheres. Due to the difference in weight per bead for both desiccants, an equal volume of each was measured rather than an equal weight.

To ensure no residual moisture was left over from previous exposure, the desiccant was restored before completing the drying test. First, the 1/8 in diameter silica gel was baked at a