

EFFECT OF NANOSILICA ON THERMAL AND RHEOLOGICAL PROPERTIES IN PROCESSING OF EPOXY IMPREGNATED TOOLING PREPREG

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ABSTRACT

Common thermal analysis methods of nanosilica (NS) fortified resin properties were initially used to predict cure time at low temperature isothermal soak conditions. Further rheometric testing of NS fortified prepreg specimens indicated a shift in time at temperature as compared to the original resin testing. This paper explores the apparent effect of NS filler on the reaction time for epoxy impregnated glass and carbon prepreg and takes a look at the means for testing actual prepreg samples to establish an accurate prediction of cure time in NS modified materials.

1. INTRODUCTION

While conducting rheometric thermal analysis at receiving inspection on glass fiber (fabric) reinforced NS fortified tooling prepreg (FTP) specimens, a noticeable shift in reaction time was measured when compared to the initial cure data provided by the manufacturer^[1]. Since the shift in time at the specified isothermal temperature was substantial, another test was conducted to substantiate the preliminary results.

After a second test produced the same delayed reaction, it was determined that more investigation was warranted and it was decided that further experiments were necessary to better characterize the apparent effect the NS had on the reaction time of the epoxy in the glass fiber reinforced prepreg tooling material.

Since glass fiber reinforced prepreg was used in the initial test, the question was then posed whether or not the same effect would be seen on carbon fiber fabric reinforced prepreg tooling materials, if tested in the same manner. It was determined that the NS fortified carbon fiber reinforced epoxy prepreg should also be tested to establish a thorough comparison.

A sample of carbon fiber fabric prepreg with the same NS fortified epoxy was ordered from the manufacturer and a test plan was developed in order to compare the reaction time of the glass and carbon prepreps to the neat (NS filled) resin data provided by the manufacturer.

The goal of this effort was to measure and record the true viscoelastic properties of both glass and carbon reinforced NS fortified epoxy tooling prepreps (specific to this manufacturer's products), compare the properties to the baseline resin rheology, and to establish recommended initial cure guidelines for use in processing tooling laminates made with these materials within the composite tool fabrication industry.

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