

In-situ rheological measurement of coatings during drying

Executive summary

This invention outlines a novel technique for the in-situ measurement of the rheology of a coating as it dries. Viscoelastic parameters such as complex viscosity (η^*), storage modulus (G'), loss modulus (G'') and damping behavior ($\tan \delta$) can be reproducibly and quantifiably measured by this technique. These parameters can be related to a range of performance attributes such as flow & leveling, anti-sag behavior, and dry-to-touch. Implementation of this methodology can be achieved by a simple modification of most commercial rheometers.

The initial 30 minutes during the drying of coatings determines many of the end-use properties such as flow & leveling, anti-sag behavior, and film formation. It is critical to be able to monitor the viscoelastic parameters that impact the aforementioned properties. At present, there is no technology readily available to a coating scientist to evaluate the fundamental rheological properties of a drying coating. In-situ drying rheology measurements can be an invaluable asset not only to screen and predict performance benefits of formulated coatings but also to design smarter and more efficient coating systems.

Eastman Chemical Company has successfully developed and patented a very sensitive probe by which the change in rheological properties can be monitored as a function of drying time. It can be routinely used to monitor the changes in the viscoelastic parameters for a wide variety of coating systems.

Technology description

To mimic the drying process of a thin film in an open air environment, a shallow circular trough and a T-bar is used. About 0.1 or 0.2 ml of liquid, depending on the depth of the trough, is typically transferred to the trough using a 1-ml tuberculin syringe. After transferring the sample to the trough, the edge of a glass slide is used to smooth the liquid surface, and the probe (T-bar) is then immersed into the liquid. A dynamic time sweep is conducted on an ARES (Advanced Rheometrics Expansion System from Rheometric Scientific, Inc.) or other comparable rheometer at certain values of frequency and strain. The complex viscosity of the coating is measured as a function of drying time. The other viscoelastic parameters can then be resolved from the complex viscosity data.

Intellectual property portfolio

US Patent No. 7,472,584: Device to Measure the Solidification Properties of a Liquid Film and Method Therefrom

US Patent No. 7,185,530: Device to Measure the Solidification Properties of a Liquid Film and Method Therefrom

Other technology and service offerings

Eastman's Technology Licensing and Alliances group focuses on the licensing, sale, donation and disposition of intellectual capital for the enterprise. The scope of our offerings can begin with the simplistic granting of rights from the Eastman patent portfolio and progress through the transfer of proprietary skills, design specifications and knowledge captured in our confidential know-how.

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For more information:

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