

# Molecular Design and Anti-Sagging Performance of Urea-Based Resin Solutions: A Multiscale Light/X-ray Structural Analysis

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## Abstract

Sagging-controlled agents (SCAs) can impart a fluid material the essential thixotropy for applications with painting and coating. In this research, four different types of urea-based resin solutions were synthesized and prepared, and their anti-sagging performance was evaluated using model paints that employ the individual resin solution as a SCA. The results revealed widely varying anti-sagging performance that calls for further exploration of the underlying structure-performance relationship. To this end, multiscale dynamic/static light and X-ray scattering analyses revealed that the urea molecules invariably self-assemble and aggregate to form micrometer-sized clusters in the background polyester solution, with distinct (internal) hierarchical structures that correlate well with their performance as SCAs. This study clearly indicates that optical scattering techniques can be a very powerful means to help establish the relationship between molecular design, structural feature, and anti-sagging performance that is crucial for current industrial research and development in identifying potential new SCAs.

***Keywords – Sagging-Controlled Agent; Optical Scattering; Resin Solution; Paint***