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Laser Scanning Confocal Microscopic Investigations of Simulated Nuclear Waste Structures

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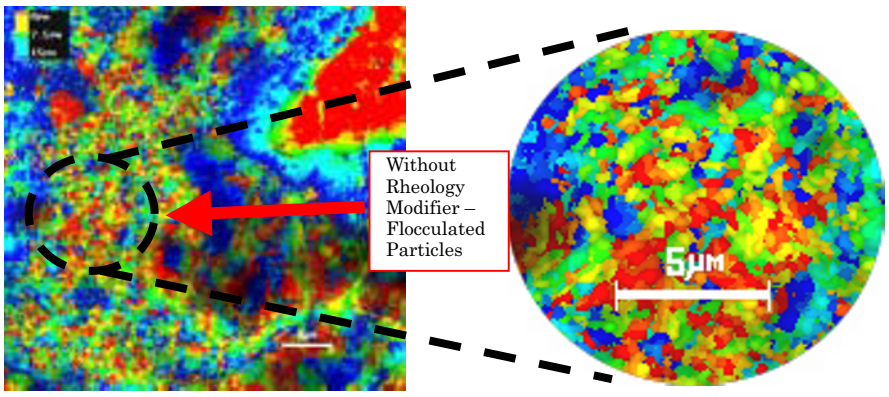

Fig. 1. Three dimensional representation of simulated high level nuclear waste without rheology modifier.

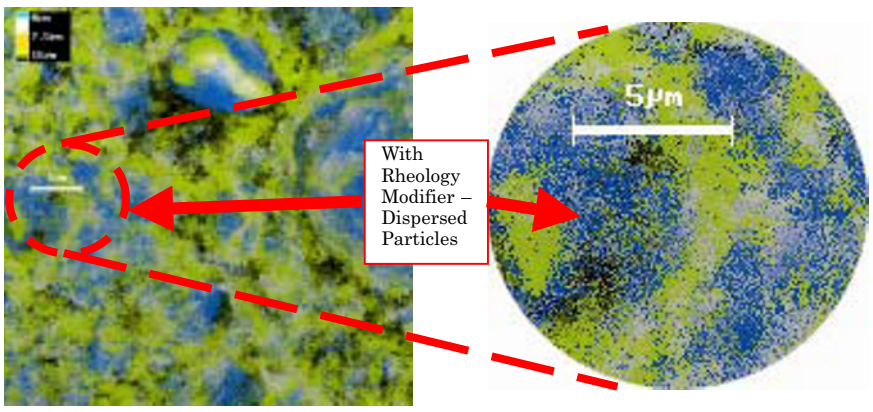

Fig. 2. Three dimensional representation of high level nuclear waste with 1000 ppm CTAB.

Researchers at the Department of Energy's Savannah River Technology Center are using advanced microscopy techniques to understand the effects of chemical surfactants (rheology modifiers) on nuclear waste slurry flow properties. Nuclear waste treatment at the Department of Energy's (DOE) weapons production facilities, Savannah River Site and Hanford Reservation, is limited by the viscosity of the nuclear waste as the material is processed through a variety of waste treatment and immobilization processes. Figure 1 shows a simulated nuclear waste slurry prior to the addition of the rheology modifier. The picture was taken using a laser scanning confocal microscope. This technique allows the slurry to be analyzed in an as-made condition. The microscope has the ability to make both two-dimensional pictures and three-dimensional representations of a sample. Figure 1 is a three-dimensional representation made by scanning two-dimensional images at 1-micron increments. These three-dimensional representations were used to understand the actual physical structure of the slurries. Figure 2 shows the same simulated nuclear waste slurry after addition of CTAB (cetyltrimethylammonium bromide), a rheology modifier. Figure 1 shows the particles to be flocculated whereas Figure 2 indicates the rheology modifier, CTAB will disperse the particles. SRTC scientists and engineers are actively researching the effects of various rheology modifiers in the hopes of increasing the throughput of the DOE nuclear waste treatment plants.