# Self-Assembly and Phase Behavior in PAMAM G3 Dendrimer–DBSNa Complexes

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Electrostatic complexes of dendrimers and amphiphilic surfactants are promising building blocks for ordered mesophases in nanostructured soft materials. Here, we investigate the self-assembly behavior of sodium dodecylbenzenesulfonate (DBSNa) with PAMAM G3 dendrimer using small-angle X-ray scattering (SAXS) and Cryo-EM. By systematically varying the dendrimer charge state ( $d_p$ ) and surfactant concentration ( $x_n$ ), a structural phase diagram was established for the G3–DBSNa system. Over most of the composition window, the complexes exhibited conventional hexagonally packed cylindrical and lamellar phases, indicating that the self-assembled structure is highly sensitive to charge state and composition. Interestingly, at a very low dendrimer charge state ( $d_p = 0.3$) and high DBSNa concentration ( $x_n > 0.7$), an additional ordered phase was identified. SAXS revealed a superlattice structure with a characteristic d-spacing approximately twice that of the conventional hexagonally packed cylindrical phase, indicating the presence of cylindrical domains with different sizes. Cryo-EM provided complementary real-space evidence by showing side-view cylindrical features with characteristic spacings consistent with those derived from SAXS. These results show that the G3–DBSNa system can form not only conventional mesophases but also a distinct superlattice structure under specific charge and composition conditions, providing new insight into the hierarchical self-assembly of dendrimer–surfactant complexes.

**Keywords:**
dendrimer,surfactant, SAXS, Cryo-EM