

Title: Self-Assembly of Carotenoids During Solution Casting of Solar Devices
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Abstract

Self assembly of carotenoids is a common phenomenon in nature and seems to be closely related to the functions of these natural dyes in solar devices. The large absorption coefficients in the visible region of carotenoids make them a well suited natural resource for dye-sensitized solar cells (DSSC). The performance of carotenoid based solar devices mainly depends on the photo-electrochemical properties of the active material (carotenoids) and their self-assembled morphology within solar devices. These associations of molecules will affect the light absorption, emission and energy harvesting abilities of these solar devices. Two types of highly conjugated natural carotenoids having mono and dicarboxy terminal groups, namely bixin and norbixin, were extracted from annatto seeds. In the current study, small angle neutron scattering experiments were carried out to examine the modes of assemblies of bixin and norbixin during solution processing of DSSCs. Spherical shape aggregates with rough interfaces were observed in acetone medium, which is a good solvent for hydrocarbon chain. The shape of the aggregates slightly deviates from spherical to slightly elongated shape at high volume fractions of carotenoids. Bixin and norbixin show different association behaviors as a function of their concentration.