

Molecular engineering of technologically relevant surfaces - Carboxylic acids on naturally oxidized aluminum

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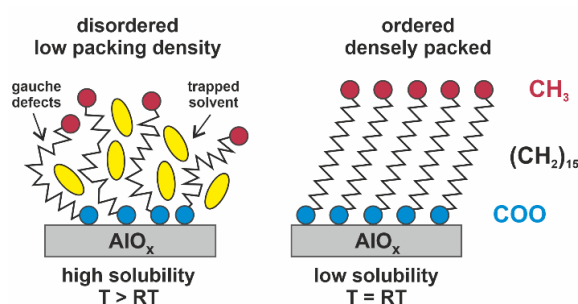
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Aluminum is a versatile, yet inexpensive metal that when covered by oxide layer might be employed as a gate dielectric in OFET devices, which carrier mobility could be enhanced by functionalization of dielectric by aliphatic carboxylic acid self-assembled monolayer (SAM)[1, 2]. Although the organization of such SAMs plays an important role for the OFET performance,[2,3] no systematical analysis of the impact of the preparation conditions on the quality of the carboxylate SAMs on aluminum oxide has been conducted so far, to the best of our knowledge. In the current work,[4] we analyze, by the example of heptadecanoic acid SAM, the influence of the three crucial factors (i.e., type of solvent, immersion time, and incubation temperature) on the quality of the monolayer prepared by the standard immersion procedure. Several complementary techniques (IRRAS, XPS, NEXAFS spectroscopy and water contact angle) are combined to demonstrate a critical role of solvent choice in terms of monolayer order, orientation, thickness, and wettability. The results indicate in particular that the high solubility hinders the creation of high-quality SAMs, probably due to the solvent molecules incorporation into the monolayer. Moreover, we show that, in contrast to archetypal thiol-based SAMs, raising the incubation temperature significantly increases the number of conformational defects in the carboxylate monolayers. As a result of this study, we propose and rationalize a set of parameters enabling to obtain densely packed and well-ordered carboxylate SAMs on naturally oxidized aluminum.



[1] Horowitz *et al.*, *Adv Funct Mater.*, **14**, 1069-1074 (2004)

[2] Lang *et al.*, *Appl Surf Sci.*, **365**, 364-375 (2016)

[3] Lee *et al.*, *J Am Chem Soc.*, **130**, 10556-10564 (2008)

[4] Cegielka *et al.*, under review (2023)