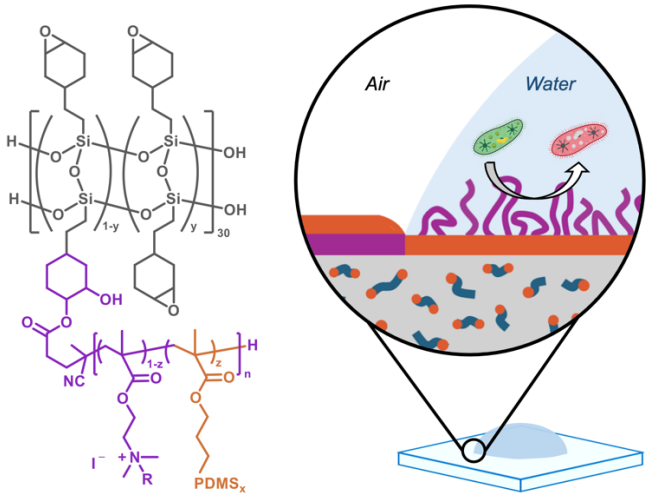
**Development of Smudge-Resistant, Antimicrobial Ladder-Like Polysilsesquioxane Coatings**

The increase in surface disinfectant usage has raised concerns regarding overexposure and environmental contamination, driving a growing interest in developing antimicrobial coatings.[1,2] For long-lasting antimicrobial performance, coatings should incorporate contact-active, surface-attached biocides and exhibit durability. The formulation of inorganic-organic hybrid coatings engineered for dual functionality—anti-smudge and antimicrobial properties—while achieving high hardness will be presented. The coatings utilize a photocured, double-grafted copolymer system, L-*g*-P(QA-*g*-S), where poly(dimethyl siloxane) (S) and quaternized poly(dimethylaminoethyl methacrylate) (QA) copolymer chains are grafted onto a ladder-like polysilsesquioxane (L) backbone. Formulated from 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane, L coatings have shown to be exceptionally hard and highly flexible, characteristic of inorganic-organic hybrid materials.[3] The double-grafted copolymer architecture facilitates controlled surface reconstruction upon exposure to moisture. In air, coatings exhibit anti-smudge properties due to the exposed hydrophobic S chains. Upon contact with droplets carrying bacterial cells, QA chains reorient to the surface to enable antimicrobial functionality through disruption of bacterial membranes. Key parameters influencing the formulation, smudge resistance, surface reconstruction, and antimicrobial efficacy of these coatings will be discussed.




***References***

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