



MSc Project: Ink adhesion to a plastic substrate



Introduction A crucial aspect of The LEGO® Group involves the inks used to decorate LEGO bricks such as minifigures' faces and bodies, utilizing advanced pad printing technology, [How are LEGO Minifigures Made?](https://www.youtube.com/watch?v=ChZotngQ3_8) (https://www.youtube.com/watch?v=ChZotngQ3_8) & [LEGO bricks In The Making](https://www.youtube.com/watch?v=C3oiy9eekzk) (<https://www.youtube.com/watch?v=C3oiy9eekzk>).

Inks are composed of a binder (small polymer molecules), a solvent, pigments, and additives. Solvents help regulate the viscosity of the inks, pigments provide the desired colour, and binder molecules serve as the carrier system for the pigments, ensuring adhesion to the substrate. The substrate is an injection moulded plastic from polyester family.

We are happy to engage a curious student in a project that investigates the influence of solvent type and quantity on ink adhesion to a substrate using atomistic simulations. Through this project, we aim to understand how the solvent diffusion takes place and explore the mechanisms involved in the adhesion between the substrate and the ink.

Goal – This MSc project will help to unravel the most important factors which define the adhesion strength of LEGO ink to polymer substrate (e.g. polycarbonate, polyethylene terephthalate) using atomistic simulations. The project will be done in close collaboration with Materials Department, LEGO System A/S, Denmark, www.LEGO.com.

Type of work In the group of prof. dr. Lyulin, molecular-dynamics (MD) simulations have been performed on different plastics. The student is asked to perform computer simulations using available software (LAMMPS, Gromacs), and develop an analysis of polymer microstructure evolution and ink adhesion strength. Concepts proposed in the literature for the analysis of viscosity, collective motion should be applied and tested.

Requirements – Expertise in programming (Python, Matlab, C...). Interest in soft matter physics and in molecular modelling.

Contact

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