# Photo-induced force microscopy and quantitative nanomechanical mapping to understand nanoplastics – Settling the baby-bottle debate

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Nanoplastics (NPs) are making an entry in recent years as the more complicated and invasive variant of microplastics (MPs). Although much is known and studied on MPs, the health and environmental effects of NPs are hard to quantify as their chemical nature and extremely small size (< 1 µm) make it hard to properly characterize them.[1]
Baby bottles, or infant feeding bottles (IFBs), have been a popular case-study for the mitigation of nanoplastics as infants are likely to be more sensitive towards hazards, and IFBs are a specific point source to them. Whereas some reports show particle formation during daily IFB use, others state this is due to precipitating leachates instead of NP generation.[2] Here, we measure particles and leachates formed during the regular use of IFBs, with an emphasis on the particle characteristics and physical properties using high-rate AFM and quantitative nanomechanical mapping, complemented by their infrared spectrum measured using PiFM, as showcased in Figure 1.

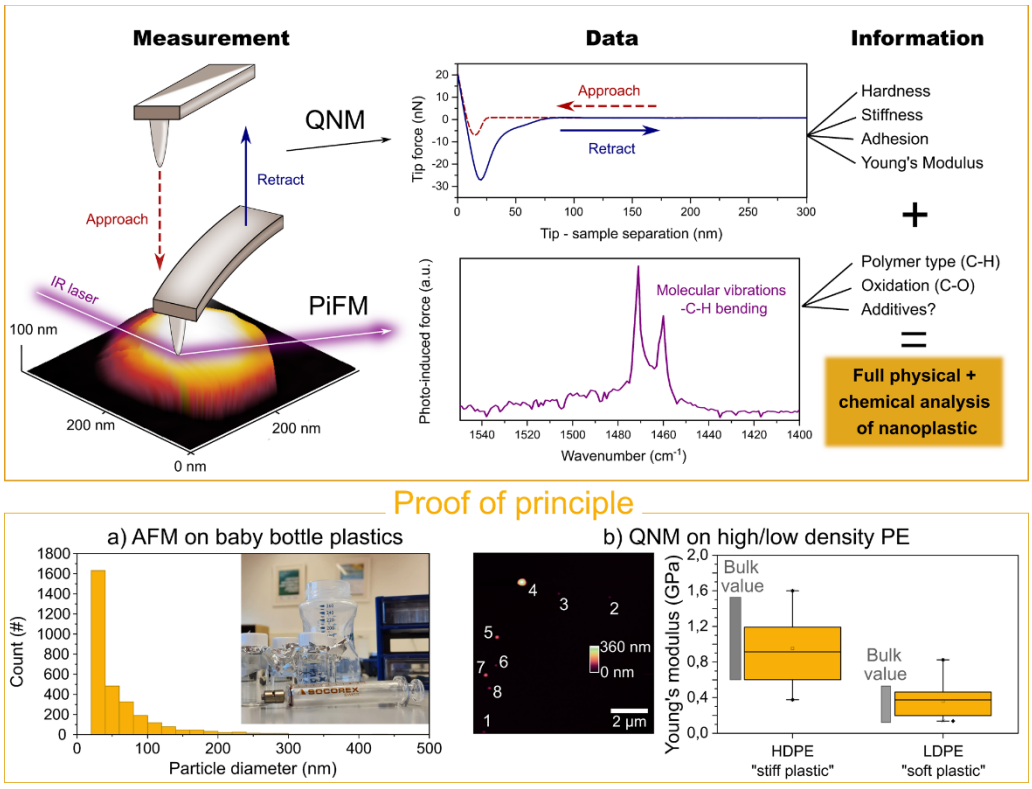


**Figure 1.** NPs generated from IFBs are measured using quantitative nanomechanical mapping and photo-induced force microscopy, providing both physical and chemical insights. The proof of principle highlights (a) the measurement of particles using high-rate AFM, (b) and QNM to measure particle-specific Young's modulus and physical properties.

[1] L. D. B. Mandemaker, F. Meirer, Angew. Chem. Int. Ed. **62**, e202210494 (2023).

[2] M. N. Gerhard, *et al.*, Food Addit. Contam. Part A **39**, 185–197 (2022).