

Soft matter is hard science: How floppy molecules influence material properties

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Plastic coatings, rubber bands or biological membranes are soft materials with astonishing properties such as being gas-tight, wear-resistant or self-healing, to name just a few. What is their secret? Soft materials are in between the solid and the liquid state. They usually consist of macromolecules that can exhibit short-range, but no long-range order, a phenomenon that leads to structure formation on the mesoscopic scale, i.e. between nm and μm . These structures then govern the properties of soft materials. Relevant interactions originate from intermolecular forces, hydrogen bonding and steric repulsion and can be tailored to suit specific demands. Of plethora of soft matter systems, a few will be picked to exemplify the concept: a) filled elastomers such as tires and bumpers and b) biomaterials like protein films, teeth and cell walls.