

Research on smart regulation of surface wettability and corrosion resistance of negative Poisson's ratio hydrogels

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Abstract This study focuses on the performance of negative Poisson's ratio hydrogels in intelligently regulating surface wettability and corrosion resistance. Negative Poisson's ratio metamaterials have counterintuitive properties. The solid surface fraction decreases with the increase of applied strain and has been proven to be able to transform into a unique superhydrophobic material ^[1].

Negative Poisson's ratio metamaterials usually have unique properties. As a new type of material, negative Poisson's ratio hydrogels are expected to play an important role in the field of smart surfaces. Through specific preparation methods, such as preparing NIPAM monomer solution by free radical polymerization and coating the surface of polyurethane foam with PNIPAM hydrogel and then curing by ultraviolet irradiation (365 nm), a surface with negative Poisson's ratio characteristics can be obtained ^[2]. This intelligent regulation of surface wettability can transform between hydrophilic and superhydrophobic states as the temperature changes. When the temperature rises, the hydrogel shrinks, the cell wall becomes thinner, and the solid-liquid contact area is reduced, realizing the transformation from the hydrophilic state at room temperature (25°C) to the hydrophobic state at a higher temperature (45°C). This characteristic provides new ideas for fields such as self-cleaning surfaces and intelligent anti-corrosion. Moreover, the study of the electrochemical behavior of metamaterial surfaces provides insights into the corrosion resistance properties of negative Poisson's ratio hydrogels. The positive shift of the polarization curve and the increase in the radius of the capacitance ring when the surface changes from hydrophilic to hydrophobic suggest that these materials have the potential to offer enhanced protection against corrosion. This understanding can guide further research and development in the field of corrosion prevention.

Therefore, negative Poisson's ratio hydrogels have great research value and application potential in intelligently regulating surface wettability and corrosion resistance.

Keywords: negative Poisson's ratio; corrosion resistance; surface wettability; smart regulation

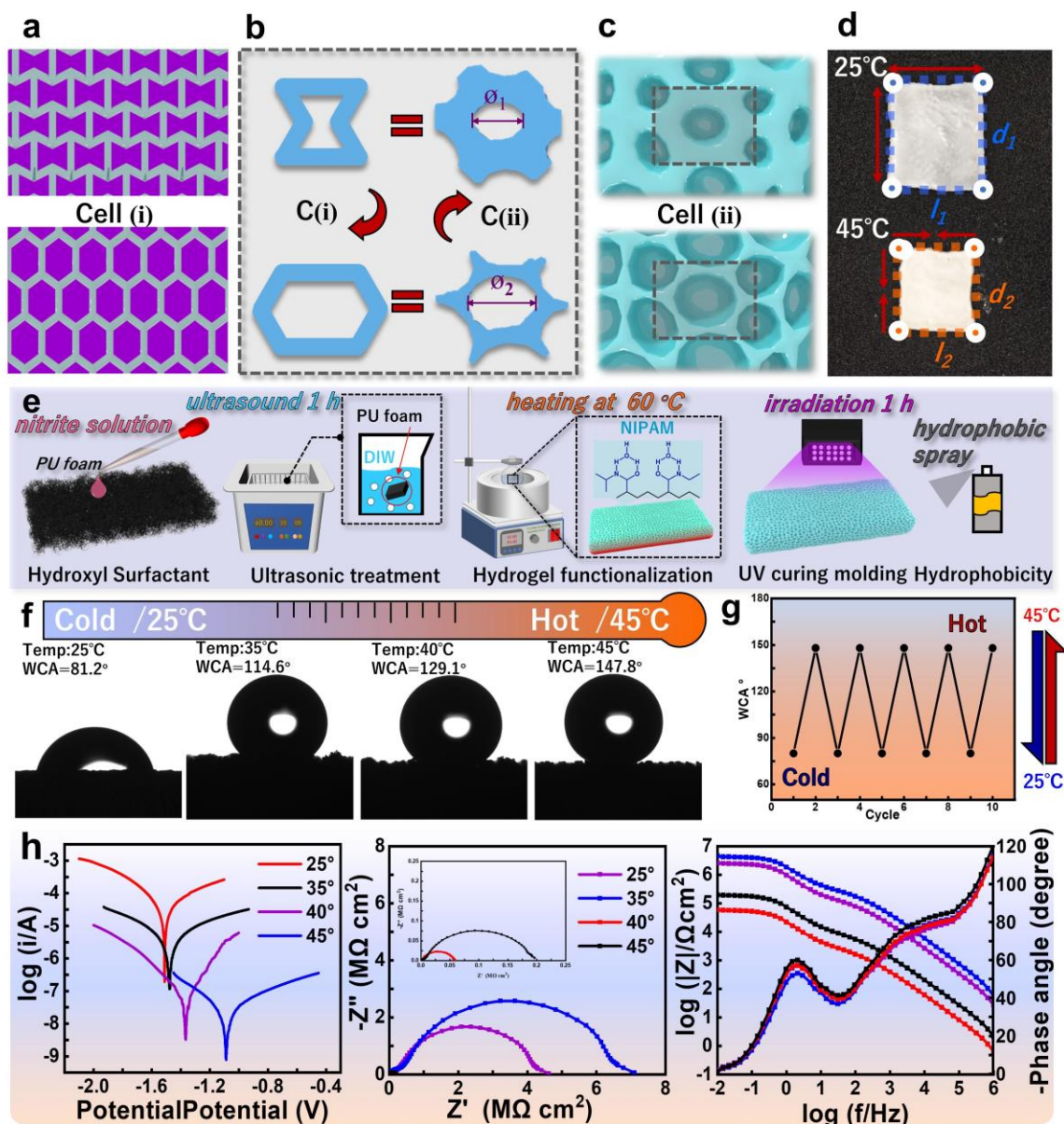


Figure 1. Auxetic behavior of (a) necked crystalline lattice metamaterials; (b), (c) structural units of smart porous responsive metamaterials; (d) PNIPAM hydrogel. And (e) Schematic diagram of the preparation process of smart responsive auxetic polyurethane sponge metamaterials; (f) Regulation of wettability on the surface of metamaterials (g) Cycle test of wettability switching; (h) Electrochemical test on the surface of metamaterials

References

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