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Mechanism of Vapor Sorption and Sorption-Induced Deformation in Bacterial Spores

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Bacterial spores have outstanding properties from the materials science perspective, which allow them to survive extreme environmental conditions. Recent work by Harrellson et al. [1] studied the mechanical properties of Bacillus Subtilis spores, and unique evolution of these properties with the change of humidity. The experimental measurements were interpreted assuming that the spores behave as water-filled porous solids, subjected to hydration forces. Here we revisit their experimental data using literature data on vapor sorption on spores and ideas from polymer physics. We demonstrate that upon the change of humidity the spores behave like hydrogels with respect to their swelling, elasticity, and relaxation times. This picture is consistent with the knowledge of the materials comprising the bacterial cell walls –cross-linked peptidoglycan. Our results provide an interpretation of the mechanics of bacterial spores and can help in developing novel synthetic materials mimicking the mechanical properties of the spores.

References:
1. Harrellson, S.G., DeLay, M.S., Chen, X., Cavusoglu, A.H., Dworkin, J., Stone, H.A. and Sahin, O., Hydration solids, Nature, 619, (2023) 500-505.
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