

Mechanics of confined hydrogel beads cluster

Silvia Monchetti^{1a}, Noy Cohen², Andrea Spagnoli³, Roberto Brighenti^{1b}

¹ Dept. of Civil & Environ. Eng., Univ. of Florence, Via di S. Marta, 3, 50139 Florence, ITALY

² Dept. of Mat. Science and Eng., Technion - Israel Institute of Tech., Haifa 3200003, ISRAEL

³ Dept. of Engineering & Architecture, Univ. of Parma, Parco Area delle Scienze 181/a, 43124 Parma, ITALY

silvia.monchetti@unifi.it^{1a}, noyco@technion.ac.il², spagnoli@unipr.it³,
roberto.brighenti@unifi.it^{1b}

EXTENDED ABSTRACT

Hydrogels are hydrophilic polymers capable of a giant volumetric expansion due to their capability of uptaking a large amount of fluid [1]. Their mechanical behavior is similar to those observed in natural living tissues, so their use is promising in a wide range of applications, especially in the biomedical field [2].

In the present study, we investigate the mechanics of swelling in confined conditions [3]; in particular, we performed experimental tests using poly(acrylamid-co-acrylic acid) beads forming a cluster of spherical hydrogel elements whose volumetric expansion takes place in presence of rigid walls forming a confining environment of different shapes.

The volumetric expansion is determined in relation to the confinement degree and to the gel beads density, quantified with respect to the adopted volume constraint. Further, the contact pressure arising between the swollen gel beads and the confining walls is determined. A simplified theoretical model is provided to describe the mechanics of swelling of a hydrogel beads cluster in confined conditions.

Finally, the implications of confined swelling of hydrogel elements arranged in a cluster are outlined in terms of possible applications and tenability of the obtainable response.

Keywords: Hydrogels; Confined swelling; Mechanics of swelling; Hydrogel Beads cluster.

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