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Structural changes in an elastin hydrogel during extension and drying by small angle neutron and x-ray scattering

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Elastin is a highly elastic protein found in connective tissue of vertebrates. It has an important mechanical physiological function by virtue of its highly elastic nature, namely to provide recoil in tissue such as skin and vasculature. The structure is extremely stable being produced mainly early in life where it persists and is not replaced during a lifetime. The structure and mechanical properties of elastin is important in many pathologies. In this study we examine the structural changes in a cross-lined elastin hydrogel during stretching and drying with small angle x-ray scattering (SAXS), and with uniaxial deformation by compression in a specially designed cell, by small angle neutron scattering (SANS).

SAXS measurements from the hydrogel at rest consisted of a broad isotropic correlation peak superimposed upon an isotropic decay in intensity. We attribute the correlation peak to the interaction between monomers and the decay in intensity to the fibres formed by linking of monomers. As the free standing film is stretched the scattering pattern becomes increasingly anisotropic. For subsequent stretches the induced anisotropy becomes increasingly irreversible as the sample dries out. The position of the correlation peak moves to higher q and the different anisotropies exhibit varying degrees of reversibility during the extensional cycles. We attribute this loss of reversibility to the drying of the sample with water acting as a plasticiser. To decouple the effects of drying from extension we have measured the SANS pattern for the elastin hydrogel during many cycles. Again the isotropic scattering pattern consisting of a correlation peaks superimposed on decay. In this case, while the anisotropic scattering pattern is entirely reversible, with a small anisotropic shift in the position of the correlation peak. The role of water in the plasticisation of tropoelastin is discussed.

Keywords or phrases (comma separated)

biomaterials, hydrogel

Are you a student?

No

Do you wish to take part in the Student Poster Slam?

No

Are you an ECR? (<5 yrs since PhD/Masters)

No

What is your gender?

Male

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