Title: Smart materials for soft robotics and their application in rehabilitation therapies

Abstract:
Hydrogels are soft biocompatible structures that resemble biological tissues more than any other material. However, the use of these systems in soft robotics has been limited to aqueous environments because hydrogels have relied on external water to swell or shrink and thus act macroscopically. This limitation can be overcome by synthesising a new type of smart hydrogels by in situ radical polymerization in the presence of graphene derivatives.
We have shown that graphene can enhance features such as biocompatibility, and sensing giving rise to truly hybrid composites. Moreover, the processes used to prepare both the nanomaterials and the final hydrogels are fully sustainable. In addition, the ability of these soft materials to self-heal, to respond to different stimuli, such as electric or magnetic fields, and the possibility of preparation following 3D printing methodologies, further expand their possibilities for different applications.
In this talk we will discuss their use in new soft robotic systems, designed to promote hand rehabilitation in a simpler, more comfortable and economical way.

Short bio:

Ester Vázquez is Professor of Organic Chemistry at the University of Castilla-La Mancha and Director of the Regional Institute for Applied Scientific Research (IRICA) where she leads a highly interdisciplinary group (MSOC Nanochemistry group). Her research focuses on the synthesis and functionalisation of nanostructures using sustainable methodologies and their use for the preparation of smart gels with applications in drug delivery, tissue engineering and soft robotics. Her research has been recognized with different awards such as the "Ibn Wafid de Toledo" Prize in 2007, the 2022 Research and Innovation In Sciences Prize from the Regional Government of Castilla-La Mancha and the award for Research Excellence from the Green Chemistry group of the RSEQ in 2025.