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Design and fabrication of stent with negative Poisson's ratio

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Abstract : The negative Poisson's ratios can be described in terms of models based on the geometry of the system and the way this geometry changes due to applied loads. As the Poisson's ratio does not depend on scale hence deformation can take place at the nano to macro level the only requirement is the right combination of the geometry. Our thrust in this paper is to combine our knowledge of tailored enhanced mechanical properties of the materials having negative Poisson's ratio with the micromachining and electrospining technology to develop a novel stent carrying a drug delivery system. Therefore, the objective of this paper includes (i) fabrication of a micromachined metal sheet tailored with structure having negative Poisson's ratio through rotating solid squares geometry using femtosecond laser ablation; (ii) rolling fabricated structure and welding to make a tubular structure (iii) wrapping it with nanofibers of biocompatible polymer PCL(polycaprolactone) for drug delivery (iv) analysis of the functional performance and mechanical properties of fabricated structure analytically and experimentally. Further, as the applications concerned, tubular structures have potential in biomedical for example hollow tubes called stents are placed inside to provide mechanical support to a damaged artery or diseased region and to open a blocked esophagus thus allowing feeding capacity and improving quality of life.

Keywords : Micromachining, electrospining, auxetic materials, enhanced mechanical properties.
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