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MRI Compatible Fresnel Zone Plates made of Polylactic Acid

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Abstract : Zone Plates (ZPs) are used in many areas of physics where planar fabrication is advantageous in comparison with conventional curved lenses. There are several types of ZPs, such as the well-known Fresnel ZPs or the more recent Fractal ZPs and Fibonacci ZPs. The material selection of the lens plays a very important role in the beam modulation control. This work presents a comparison between two Fresnel ZP made from different materials in the ultrasound domain: Polylactic Acid (PLA) and brass. PLA is the most common material used in commercial 3D-printers due to its high design flexibility and low cost. Numerical simulations based on Finite Element Method (FEM) and experimental results are shown, and they prove that the focusing capabilities of brass ZPs and PLA ZPs are similar. For this reason, PLA is proposed as a Magnetic Resonance Imaging (MRI) compatible material with great potential for therapeutic ultrasound focusing applications.

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