# Light-Assisted 3D Printing of Liquid Metal@Au Composites Hydrogels for Photothermal Antibacterial Applications

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The increasing prevalence of antibiotic-resistant bacteria necessitates the development of alternative antibacterial materials[1]. In this study, we report a digital light processing (DLP)-printed gelatin methacryloyl (GelMA) hydrogel incorporating a low concentration (0.5% w/v) of gold-coated liquid metal nanoparticles (LM@Au) (termed LM@Au/Gels). The LM@Au were synthesized via a two-step sonication–galvanic replacement method[2] and exhibited a well-defined core–shell architecture with enhanced photothermal conversion capability. Uniform dispersion of LM@Au in the hydrogel network yielded constructs with high printing resolution, improved compressive properties, and customized geometries. Upon 808 nm near-infrared (NIR) irradiation at 0.5 W/cm², LM@Au/Gels demonstrated efficient photothermal heating and pronounced antibacterial activity against both Gram-positive and Gram-negative bacteria, achieving >98% reduction in viability. In contrast, LM/Gels showed limited efficacy. Cell viability assays confirmed acceptable cytocompatibility of all formulations. Live/dead staining and SEM imaging indicated that bacterial membrane disruption underlies the photothermal bactericidal mechanism. These results highlight the utility of LM@Au/Gels as NIR-responsive antibacterial scaffolds for potential use in wound management and infection control.

[1]X.Huang, L.Zhang, N. K. A.Nasar, et al. *Advanced Functional. Material* **2026**, 36, no. 26: e23767.

[2]H.Lu, S.-Y.Tang, J.Zhu, X.Huang, H.Forgham, X.Li, A.Shen, G.Yun, J.Hu, S.Zhang, T. P.Davis, W.Li, R.Qiao, *Advanced Functional. Material* **2024**, 34, 2311300.