

PLA-PEKK-HAp-CS composite scaffold joining with friction stir spot welding

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ABSTRACT

This article reports joining feasibility of polylactic acid-polyether ketone ketone-hydroxyapatite-chitosan composite scaffold with consumable tool in friction stir spot welding (FSSW) as a novel process. Also, investigations have been made for mechanical, thermal, and morphological characteristics of the joints prepared. The results for joint strength are supported with axial/transverse force and interface temperature measurement for bone scaffolds. The FSSW process parameters, namely rotational speed, pin depth, and stirred time, have been varied to correlate the changes in force and temperature with mechanical and morphological properties. The results of the study highlighted that ultimate tensile strength (6.57 MPa) and flexural strength (139.2 MPa) were obtained best at 800 r/min rotational speed and 20 s stirring time with 2.5-mm pin depth.

KEYWORDS

Friction stir spot welding; Interface temperature; Mechanical properties; PLA composite

REFERENCES

1. Vijendra, B., Sharma, A. [Induction heated tool assisted friction-stir welding \(i-FSW\): A novel hybrid process for joining of thermoplastics](#) (2015) *Journal of Manufacturing Processes*, Part 1 20, pp. 234-244
2. Jaiganesh, V., Maruthu, B., Gopinath, E. [Optimization of process parameters on friction stir welding of high density polypropylene plate](#) (Open Access) (2014) *Procedia Engineering*, 97, pp. 1957-1965.
3. Eslami, S., Ramos, T., Tavares, P.J., Moreira, P.M.G.P. [Effect of Friction Stir Welding Parameters with Newly Developed Tool for Lap Joint of Dissimilar Polymers](#) (Open Access) (2015) *Procedia Engineering*, 114, pp. 199-207.
4. eglowska, A., Pietras, A. [Influence of the welding parameters on the structure and mechanical properties of vibration welded joints of dissimilar grades of nylons](#) (2012) *Archives of Civil and Mechanical Engineering*, 12 (2), pp. 198-204.
5. Barmouz, M., Seyfi, J., Kazem Besharati Givi, M., Hejazi, I., Davachi, S.M. [A novel approach for producing polymer nanocomposites by in-situ dispersion of clay particles via friction stir processing](#) (2011) *Materials Science and Engineering A*, 528 (6), pp. 3003-3006.