

ABSTRACT

Disability refers to physical impairments in individuals caused by various factors such as congenital defects, accidents, or nerve damage. In Indonesia, only 18% of disabled individuals have access to prosthetic devices due to their limited availability. Epoxy resin/carbon fiber composite materials offer a lighter, stronger, and more durable prosthetic option compared to other materials. This material is chosen based on the need for prosthetics that are not only functional but also comfortable and aesthetic.

The study focus on the manufacturing process of an epoxy/carbon fiber composite using the wet hand lay-up method. The research includes material selection, composite orientation structure arrangement, matrix and hardener mixing process, CNC Router cutting, cleaning, mechanical property testing, and the fabrication of a prosthetic index finger. The composite consists of a mixture of carbon fiber, epoxy resin matrix, and hardener AM8927-B. The fiber-to-matrix ratio is 1:1,1, while the resin-to-hardener ratio is 100:30. The fiber orientation is set at 0° with six layers to provide optimal mechanical strength in two directions.

The epoxy resin/carbon fiber composite used in the prosthetic finger shown a good performance in various tests. Despite using the wet hand lay-up method, which presents challenges such as voids, improvements in the fabrication process minimized these defects. The tensile strength of the composite varies depending on the fiber cutting orientation. The tensile strengths for 0° , 45° , and 90° orientations are 707.92 MPa, 175.28 MPa, and 709.66 MPa. The 0° orientation provides an average bending strength of 300.66 MPa, compressive strength of 12.77 MPa, and a density of 1,37 g/cm³. The composite shows high-temperature resistance, with only 5% mass loss at 300°C and 87% loss at 1000°C. The prosthetic finger made from this composite is capable of withstanding a load up to 600 ml of water and performing daily activities without damage.

Keywords: Carbon Fiber, Composite, Epoxy Resin, Prosthetics, Wet Hand Lay-Up.