304-224

MECHANICAL PROPERTIES OF WELDED JOINTS OF NITI SHAPE MEMORY ALLOYS: A COMPARATIVE STUDY BETWEEN THE GTAW, PAW AND LBW PROCESSES

Melo, R.H.F.(1); Oliveira, M.J.C.(2); Maciel, T.M.(2); Araújo, C.J.(2); De Lima, M.S.F.(3);
Instituto Federal da Paraíba(1); Universidade Federal de Campina Grande(2); Universidade Federal de Campina Grande(3); Universidade Federal de Campina Grande(4); Instituto de Estudos Avançados(5);

Shape Memory Alloys are a unique and special class of materials with capacity to recover pseudo plastic strains when temperature is changed, contrary of the most commonly used metals. Use of a material for industrial purpose may be limited unless processing technologies are developed or joint techniques of the material to itself are improved. Given the ubiquitous use of NiTi among all the commercially SMAs, researchers over the past two decades have focused on the use of reliable joining techniques, like welding, to connect NiTi to itself. There's a great challenge, however, on joining similar NiTi joints due the formation of intermetallic compounds which leads to hot cracking associated to interdendritic microstructure; precipitation of deleterious phases in the heat affected zone and columnar brittle structure on the weld bead, resulting on severe strength reduction. These drawbacks are responsible for NiTi alloys limiting applications in multiple areas of interests. The main welding process to join NiTi is the Laser Beam Welding (LBW) for its excel in high precision and localized heat input resulting on narrow heat affected zone (HAZ). Despites its benefits regarding welded joints the LBW it's a costly process which restricts widely its applicability. Arc welding process like the Gas Tungsten Arc Welding (GTAW) is commonly utilized for industrial applications. It's well known GTAW results in high integrity joints for steel, aluminum, copper and further alloys. One could expect the same for NiTi alloys. This study aimed in improving the mechanical properties on thin sheets of Nickel-Titanium (Ni-Ti) shape memory alloy (SMA) welded joints obtained by GTAW, PAW and LBW processes. The effects on mechanical properties of welding parameters and post-weld heat treatment are studied by strain x stress curve. Ni-Ti welded joints achieved ultimate tensile strength of 760MPa and 23% strain in GTAW welding process, 550 MPa and 11% strain in LBW, 500 MPa and 8% strain in PAW welding process.