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Experimental analysis on the use of structural epoxy adhesive for joining niti sma superelastic wires

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Shape memory alloys (SMA) are making it possible to innovate traditional engineering projects because of two main phenomena. The first is the shape memory effect, which allows large pseudoplastic deformations (4 to 8% in uniaxial traction) to be recovered after heating. The second characteristic, superelasticity (SE), allows deformation recovery of 10% (in uniaxial tension) when loading ceases. SMA has a wide range of applications, ranging from automotive to biomedicine. Among the most studied SMA are the metallic Ni-Ti. There are many challenges in the development of applications with SMA, and one of them is the welding for these materials, which is expensive and complex and has yet to achieve significant results for its industrial application. This research sought to evaluate an adhesive bond with Ni-Ti wires, aiming to determine whether the adhesive allows the effect of SE to occur in the proposed adhesive joint after mechanical testing. To obtain the test specimens (TSs), orthodontics wires with a square section of Ni-Ti SE, two-component epoxy structural adhesive DP460 Off-White, and polypropylene tubes to assist in the overlapping (simple) of wires on the adhesive were employed. The TSs were prepared with different adhesive joint widths, and the uniaxial tensile tests were performed at room temperature, according to ASTM F2516/14 standard. After carrying out the uniaxial tensile tests, somebody found that the union of the Ni-Ti wires through a structural adhesive proved effective in adherence. The TSs presented resistance to rupture and slippage of the wires, which allowed the formation of the characteristic plateau of the SE effect, well around 300 MPa, with the presence of a hysterical loop, that is, similar to the mechanical characteristic presented by the intact single Ni-Ti wire. Results show promising results and additional studies will be needed to contribute to using adhesive unions with SMAs.