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Laser processing of NiTi wires for actuator applications

Shape memory alloys (SMA) exhibit exceptional actuator and sensory functionalities utilized in various industrial sectors such as aerospace and automotive. In these sectors, where lightweight, silent operation and high performance are crucial requirements, they are gaining increasing significance. The incorporation of a wire actuator into a design necessitates additional developmental steps for attachment due to the absence of standardized and pre-assembled actuators. These steps require significant expertise from the user in the field of shape memory alloy actuators, which limits their potential. Lasers are an important tool for processing and welding NiTi SMA in research since they apply the energy locally at high densities and thus minimize the heat-affected zone. However, the successful machining of NiTi relies heavily on precise control of process temperatures. Particularly with smaller material volumes such as wires, the risk of uncontrolled overheating exists, as the usage of constant laser power does not provide control of the process temperature due to the high process dynamics. This talk will provide an overview of two laser-based approaches for integrating NiTi into actuator applications.