New specimen design improves rapid fatigue testing

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What is the outcome or accomplishment? (1-2 short sentences describing it and why it is transformative: 50-word maximum suggested) *

A new small-sized test specimen has been designed by researchers with the Louisiana Materials Design Alliance (LAMDA) to accelerate bending-fatigue testing. Small-sized test pieces are more adaptable, economical, and timesaving in fabrication processes and contain quantifiable imperfections and defects, which makes them highly desirable for rapid qualification of new alloys and new fabrication processes.

What is the impact? (1-2 simple sentences describing the benefits for science, industry, society, the economy, national security, *etc.*; suggested 50-word maximum)

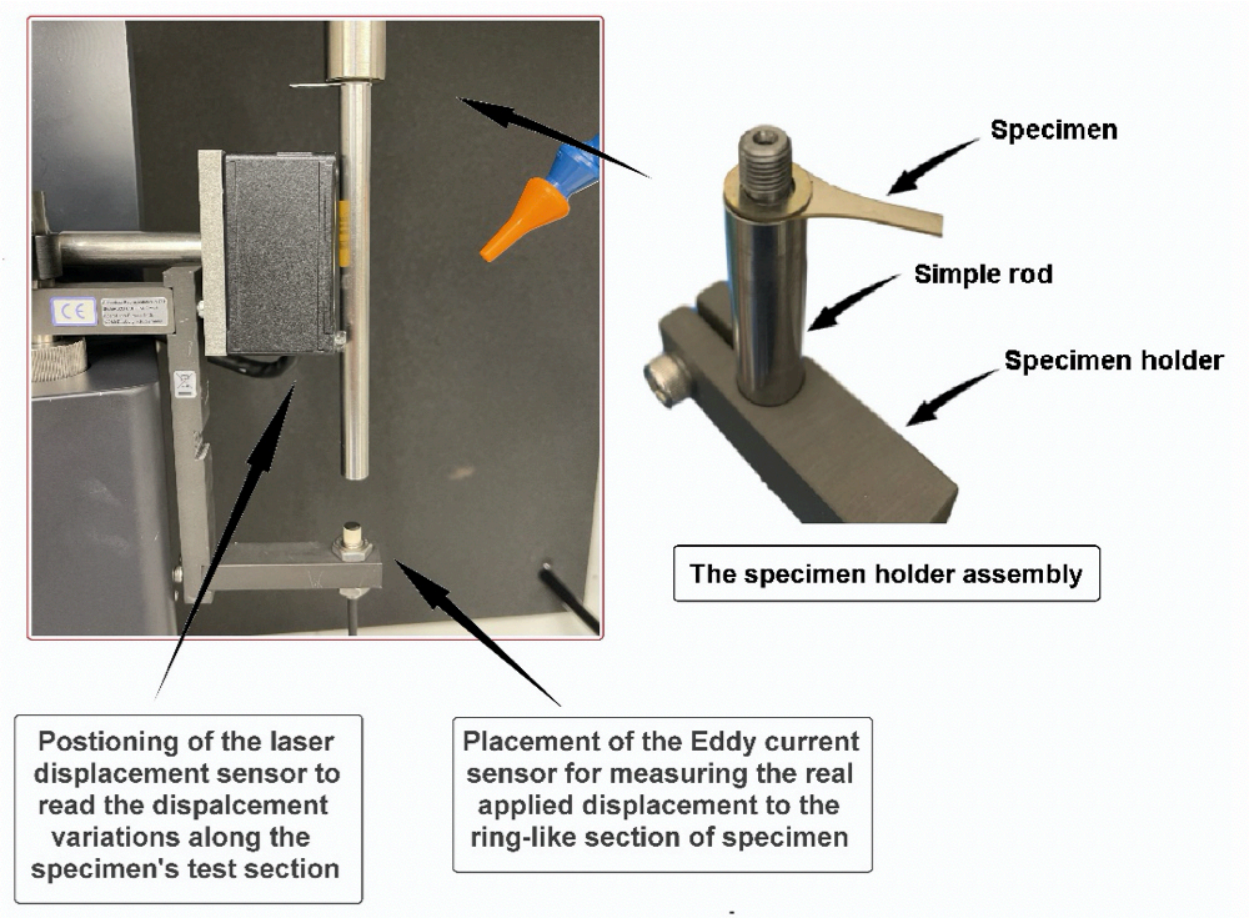
This new design of a small-sized test specimen enables fatigue property studies of new 3D printed alloys to be carried out rapidly and with significantly reduced cost. Rapid fatigue testing capability helps scientists to explore new alloys and 3D printing techniques for reliable and durable products.

What explanation/background does the lay reader need to understand the significance of this outcome? (1-2 paragraphs that might include, for example, more on who, when, where; NSF's role; support from multiple directorates/offices; what makes this accomplishment unique; additional intellectual merits; or broader impacts such as education, outreach, or infrastructure improvement that are integral to this outcome; suggested 150-word maximum)

Fabrication of test pieces and doing experiments on them is important, particularly for additive manufacturing (AM) studies, like developing new AM alloys, investigating proper AM design, and studying the effects of AM build parameters on the mechanical properties. Fatigue testing is an essential part of such studies, and the high-cycle life regimes are time-consuming and costly, and a large number of test specimens with a suitable design are needed. For AM research, scientists also encounter severe restraints such as limited building-capacity, small chamber size, high costs, and unpredictable microstructure defects. Ultrasonic high-frequency fatigue testing systems overcome the time- and cost-related limitations, and in addition, reducing the size of the test specimens is a way to tackle the above-mentioned obstacles. Small-sized test specimens are

also beneficial from the affordability point of view as they make the controlling of the manufacturing processes more feasible, and thus, they facilitate the production of more qualified specimens under a variety of different processing conditions.

Louisiana State University graduate student Hamed Ghadimi working with SHIMADZU USF-2000 ultrasonic fatigue testing system.



Bending-fatigue testing setup and designed small-sized test specimen.