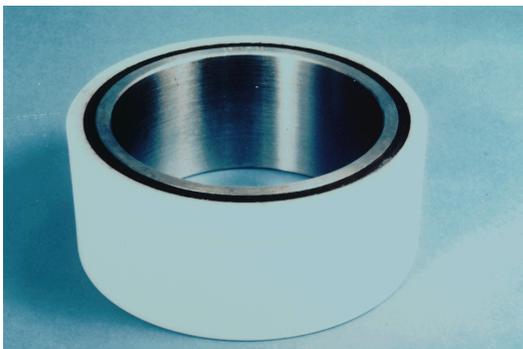


Science and Technology Success Stories

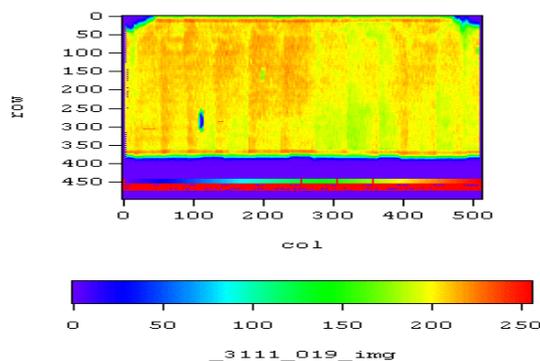
NDE of Submarine Shaft Vibration Reducers

The Naval Research Laboratory (NRL), the Navy's corporate laboratory, has developed an ultrasonic procedure for nondestructive inspection of adhesively bonded concentric cylindrical laminates for any manufacturing defects. These Polyethylene-Rubber-Steel laminates are used for reducing submarine shaft vibrations. Submarines of various classes e.g., SSN 637, SSN 688 and SSN 21 require different sizes of these inserts. It is very important that these adhesively bonded inserts do not have any defects, such as delaminations, weak bonds or voids.

NRL's ultrasonic integrity program for vibration reducers has been validated through a series of tests. Inserts suspected to have delaminations as determined from analysis of transmission ultrasonic C-scan data, were sectioned and inspected using peel tests to visually confirm suspected delaminations. The excellent agreement between nondestructive ultrasonic images and micrographs of delamination validated this non-destructive methodology. Procedures for NDE inspection and specifications for Accept/Reject criterion were provided to NAVSEA. Technical support was provided for inspection of several hundreds of these inserts for the Navy.



Adhesively bonded rubber bonded insert for reducing shaft vibrations in submarines.



Unwrapped 2-D nondestructive ultrasonic mapping of the insert. Blue regions on top left and right-corners and a vertical streak in the lower left region indicate defects.

NDE of Submarine Shaft Vibration Reducers

Military Impact

- **Improved Capability for:**
 - **Rapid, reliable, nondestructive 100% imaging for delaminations, and voids.**
 - **Reduction in shaft vibrations for stealth operation.**

Potential Civilian Spin-offs

- **Capabilities for:**
 - **Aerospace adhesively Bonded Layered Structures.**
 - **Automotive Brakes.**

Point of Contact

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