



Ultrasonic Technologies, Inc

UST = Ultimate Smart Tools

2622 Cypress Ridge Blvd, suite. 103
Wesley Chapel, Florida, 33544, U.S.A.

www.ultrasonictech.com

CRACK DETECTION IN CERAMIC ARMOR PLATES

Resonance Ultrasonic Vibrations (RUV) Technology

High reliability and accuracy

High throughput

Real-time

Non-destructive

RUV TECHNOLOGY

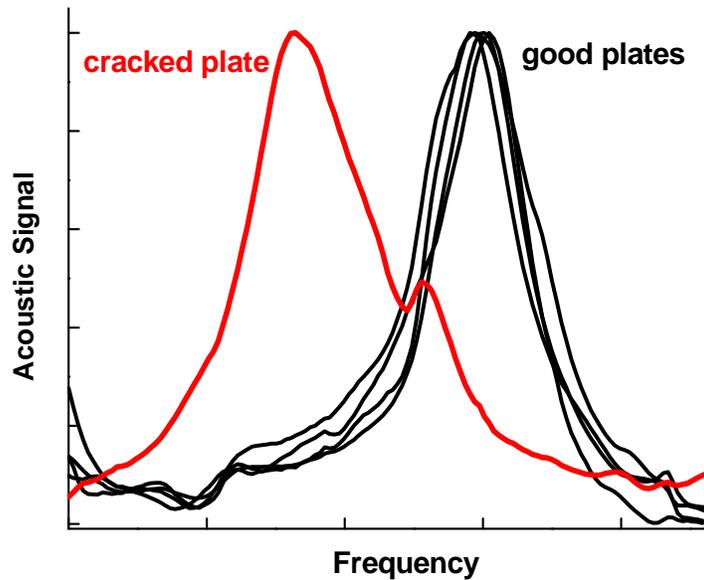
The Resonance Ultrasonic Vibrations (RUV) technology was developed for real-time non-destructive detection of cracks and other process flaws in production grade ceramics used in protection armor plates. The RUV technology implements fast non-destructive measurement of the resonance response in ceramic substrates with invisible peripheral or bulk cracks which deviates from the response of non-cracked standard substrates.

Ceramic substrates used to manufacture armor plates are the primary contributors to the overall performance of the finished product. Quality controls, in regard to cracks as well as process control in production, are two primary aspects that require advanced testing effort. To ensure that armor plates (SPEAR, Gen III, SAPI) are not damaged and adhere to performance standards, periodic quality inspection is a requirement for armor plates employed in combat and special operations as well as after storage, shipping and transportation.

RUV technology provides (1) fast and non-destructive inspection of mechanical flaws (**cracks, delamination**) during the plate's production; (2) detection of these mechanical flaws in fully assembled plates after deployment during periodic quality inspections in the field; and (3) cost-effective solution to quality control and maintenance service. Additionally, the RUV system serves as a process improvement tool that increases yield by eliminating production flaws caused by mechanical defects.

FREQUENCY CURVE

Through a resonance frequency curve selected from a broad range (20 - 250 kHz) the RUV method enables crack detection with simple quantitative criteria for ceramic armor plates. A crack introduced into ceramic substrate alters RUV peak parameters: bandwidth and peak position. This is illustrated in Figure 1 by comparing RUV curves measured on four standard plates with the identical plate rejected due to internal crack. Specifically, the crack in the plate shows the following features: (1) a frequency shift of the peak position, and (2) an increase of the peak bandwidth. Therefore, the RUV approach is based on fast measurement and analysis of a specific resonance peak and rejection of the suspect sample if peak characteristics deviate from similar non-cracked samples.



Deviations of the resonance peak caused by a crack in ceramic plate

The sensitivity of the system, which refers to the length of the cracks, is adjustable to the needs of the end user. The rejection method is based on a statistical approach. In case studies, the capture rate of RUV method approaches 100%.

For more information, please contact us through the Ultrasonic Technologies web-site, www.ultrasonictech.com.