

Monitoring and Control of the Hybrid Laser-GMAW Process

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Welding is a key process, a building of nuclear energy plants. One promising welding process of interest combines gas metal-arc welding (GMAW) and laser beam welding (LBW) into Hybrid Laser-Gas Metal-Arc Welding (LBW/GMAW), exploiting the synergistic effects of the conventional GMAW process and powerful lasers. One great aspect of hybrid process is the high speed at which welds can be made. With weld speeds measured in inches per second rather than minutes, this has the downside of being able to make a lot of bad weld very quickly. Design of inspection probes capable of finding flaws early and possibly providing the information to correct the process on the fly is the goals of this project, lead by Idaho National Laboratory in collaboration with Edison Welding Institute and Electric Power Research Institute.



Impact and value to nuclear applications: When fully productized, the probes and systems produced by this project can enhance fabrication process for nuclear and other industries by detecting problems that lead to expensive repairs or scrapped material early in the process. The application also has the potential to provide automatic feedback to proactively adjust the process through feedback to the welding system (e.g. adjust laser power weld is not complete) to maintain weld quality. Ultimately, the technology seeks to achieve acceptance by nuclear energy safety stake holders for incorporating the inspection into the welding process, saving time and money in fabrication of nuclear power plants.

Recent results and highlights: The real phased array ultrasonic probe has been operated and evaluated during welding. The probe has the ability to show an incomplete weld profile following a mere three inches behind the weld torch. Additional tests are being planned for this and the EWI eddy current probe later in the year.

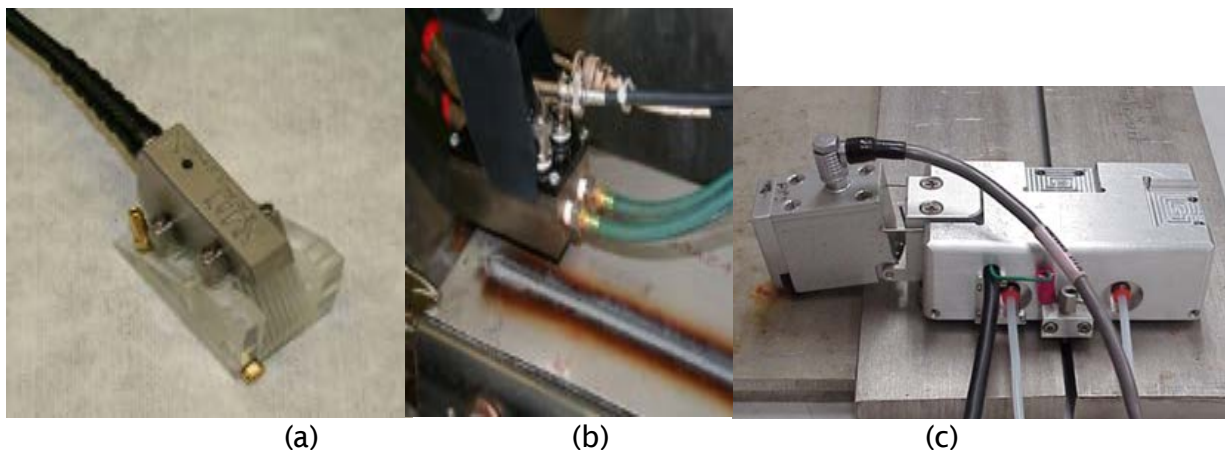


Figure 1. Shown in (a) phased array ultrasonic probe for real time diagnostics, (b) eddy current sensor for GMAW lack of fusion inspection, and (c) full weld eddy current inspection probe.