

New study reveals solidification cracking during welding of steel

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New research led by the University of Leicester has made a novel breakthrough in understanding how solidification cracking occurs during the welding of steel, an important engineering alloy.

In a new study, which has been published in the journal *Scientific Reports* from *Nature*, the team from the University of Leicester Department of Engineering propose that solidification cracks grow by linking micro-porosities in the meshing zone in the solidifying weld pool.

This is the first time that researchers have observed [solidification](#) cracking in steel and sheds new light on why the alloy may crack during the process.

Professor Hong Dong from the University of Leicester Department of Engineering said: "Welding is the most economical and effective way to join metals permanently and it is a vital component of our manufacturing economy.

"It is estimated that more than 50 per cent of global domestic and engineering products contain welded joints. In Europe, the welding industry has traditionally supported a diverse set of companies across the shipbuilding, pipeline, automotive, aerospace, defence and construction sectors. Solidification/hot cracking is the most common failure mode during metal processing, such as [welding](#), casting and metal additive manufacturing (metal 3-D printing)."

The team used synchrotron X-ray beamline at the European Synchrotron Radiation Facility (ESRF) to observe the crack formation at the real time.

With modern advances in synchrotron X-ray and imaging techniques, the team was able to see through metals, providing details analysis of the alloy.

Weaknesses in welded parts can have many disastrous effects including putting lives at risk and harming the economy because of damages and insurance payouts for faulty products.

They can also cause environmental catastrophes such as pollution if imperfectly welded parts are used in environmentally sensitive areas such as the ocean.

More information: L. Aucott et al. Initiation and growth kinetics of solidification cracking during welding of steel, *Scientific Reports* (2017). [DOI: 10.1038/srep40255](https://doi.org/10.1038/srep40255)

Provided by University of Leicester

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