

Quality assessment of

Friction Stir Welds

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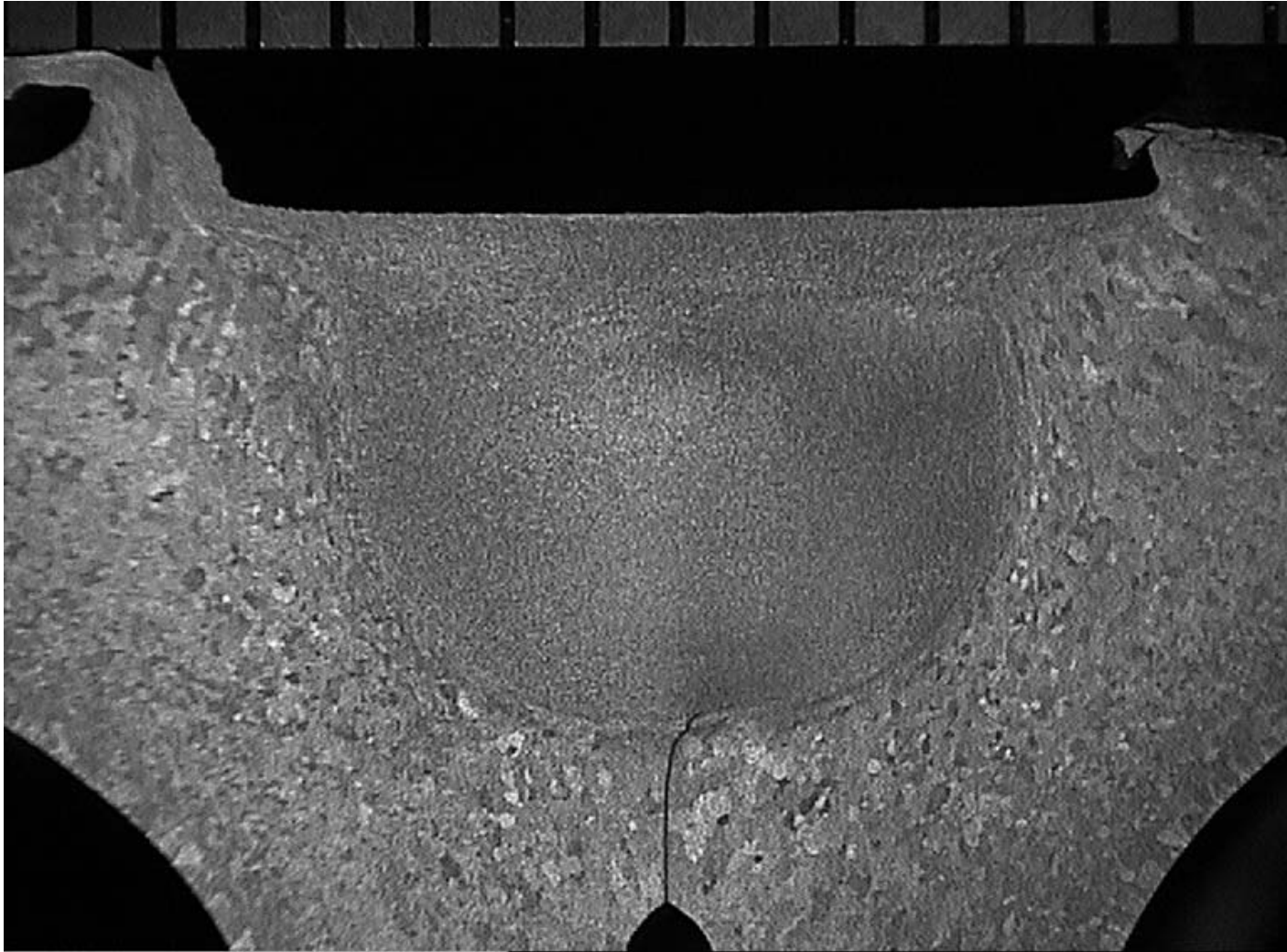
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- **FSW is similar to other welding processes**
- **Qualify procedures and operators**
- **Assure tolerances and fit-up**
- **Inspect and test**

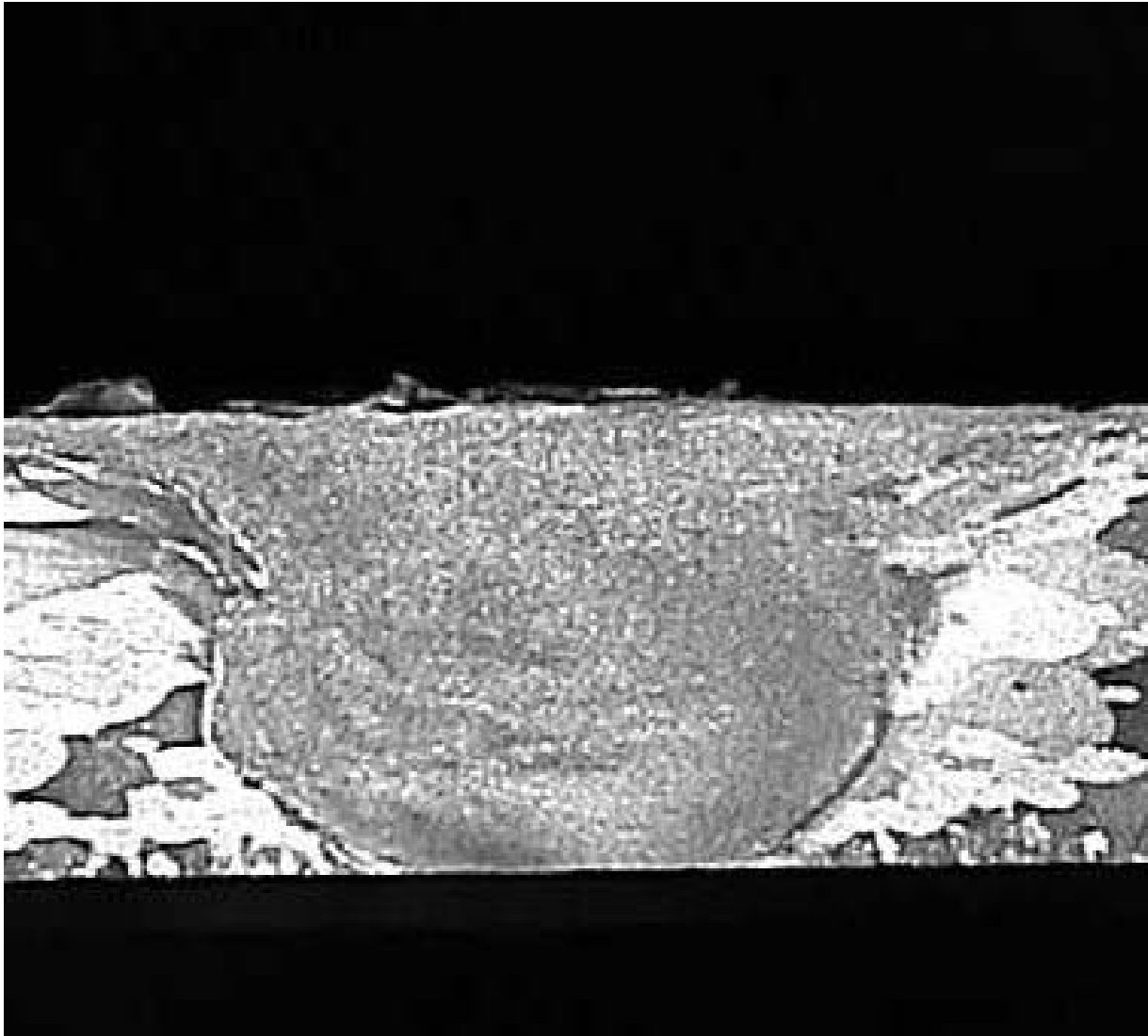
- **Procedure qualification – in line with EN-ISO 15614-2 (DIS 25239-4)**
- **Operator qualification – in line with EN1418/ISO 9606-2 (DIS 25239-3)**
- **Third-party qualifications if required**

- Gap max 0,1t / 0,5 mm
- Misalignment max 0,5 mm

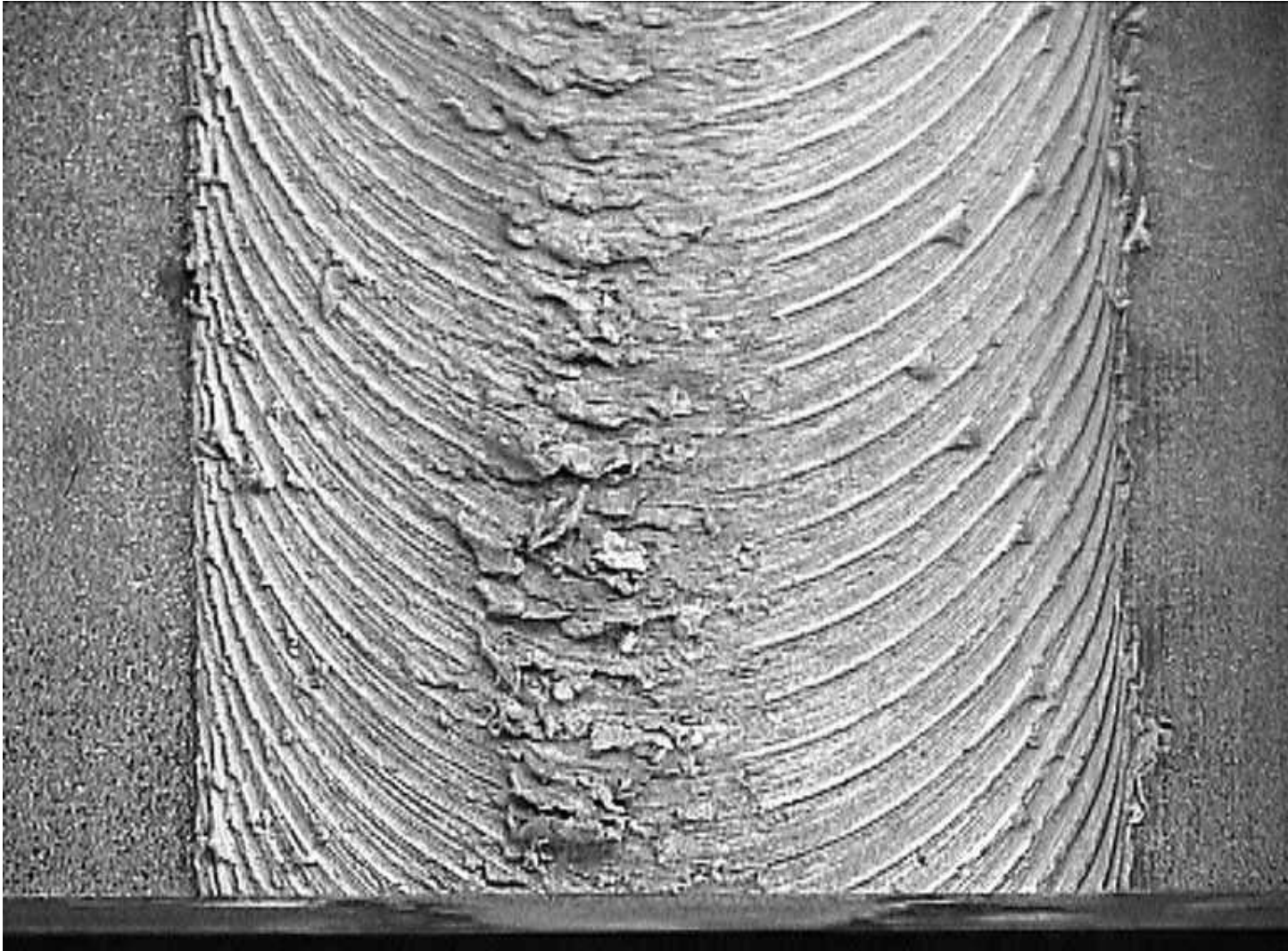
- **Common to fusion and friction stir welding**
 - Undercut/underfill
 - Overlap/flash
- **Specific to Friction stir welding**
 - Faying surface flaw
 - Void
 - Joint line remnant (JLR)
 - Lack of penetration (LOP)

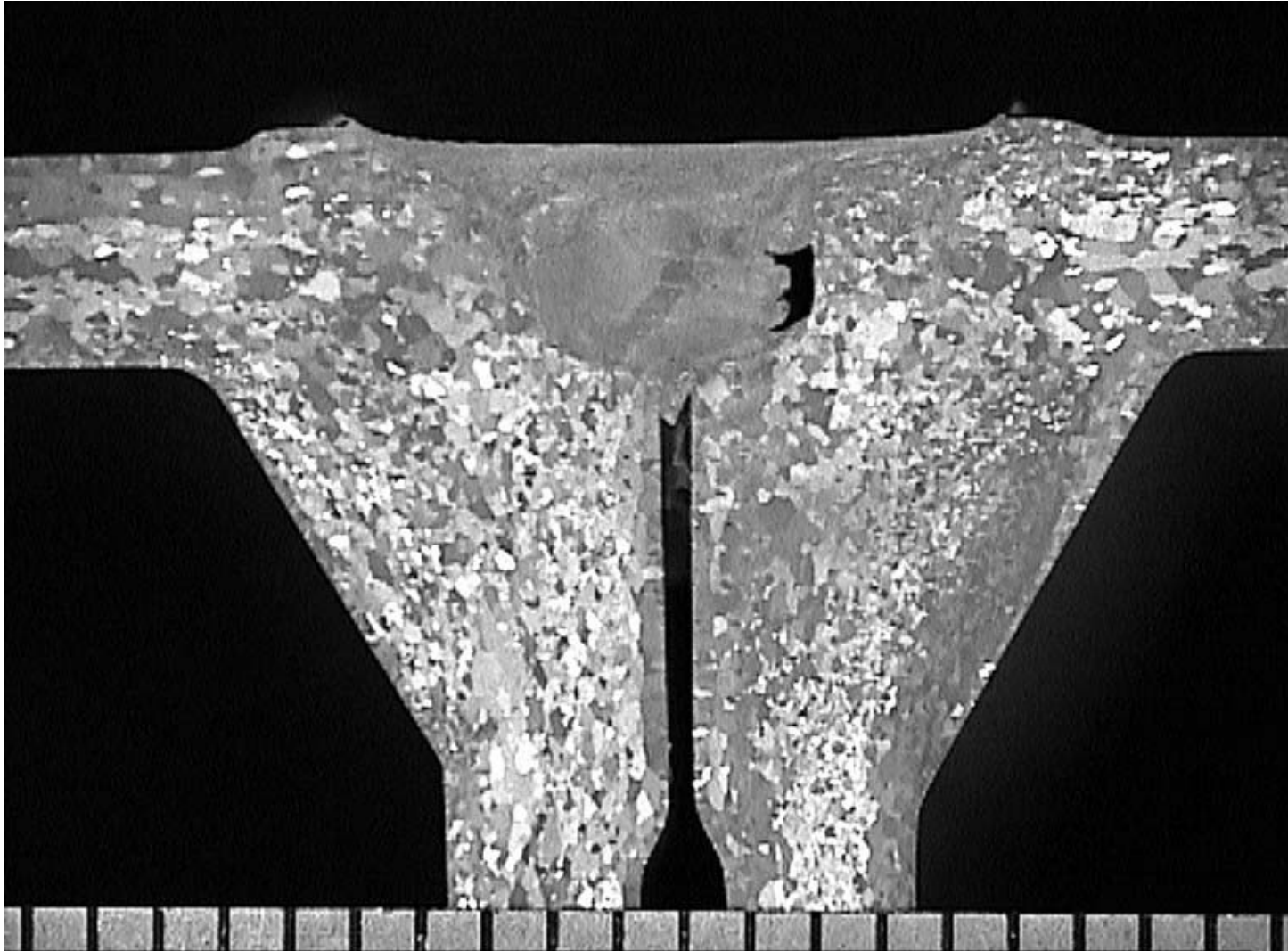


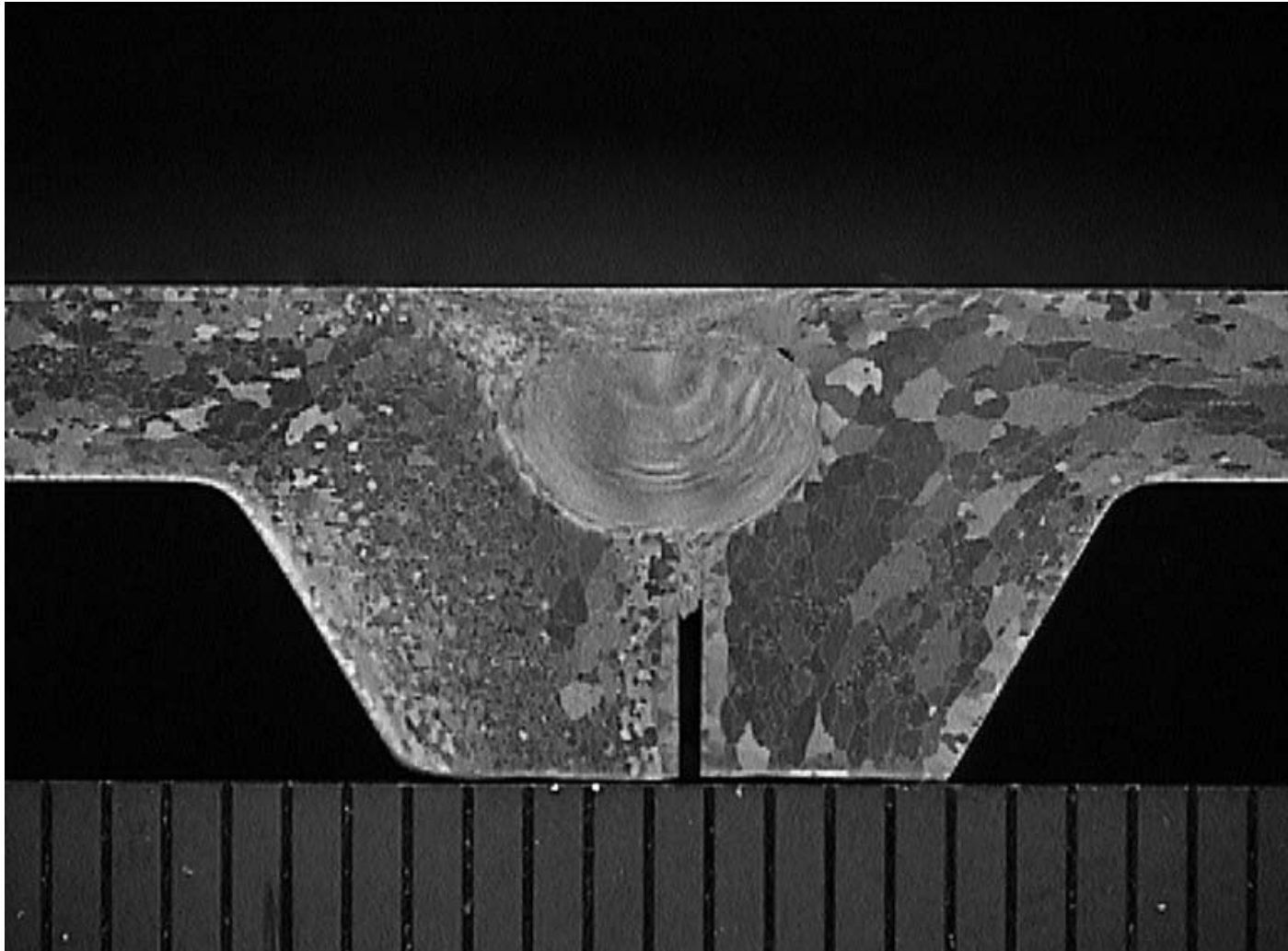
Faying surface flaw



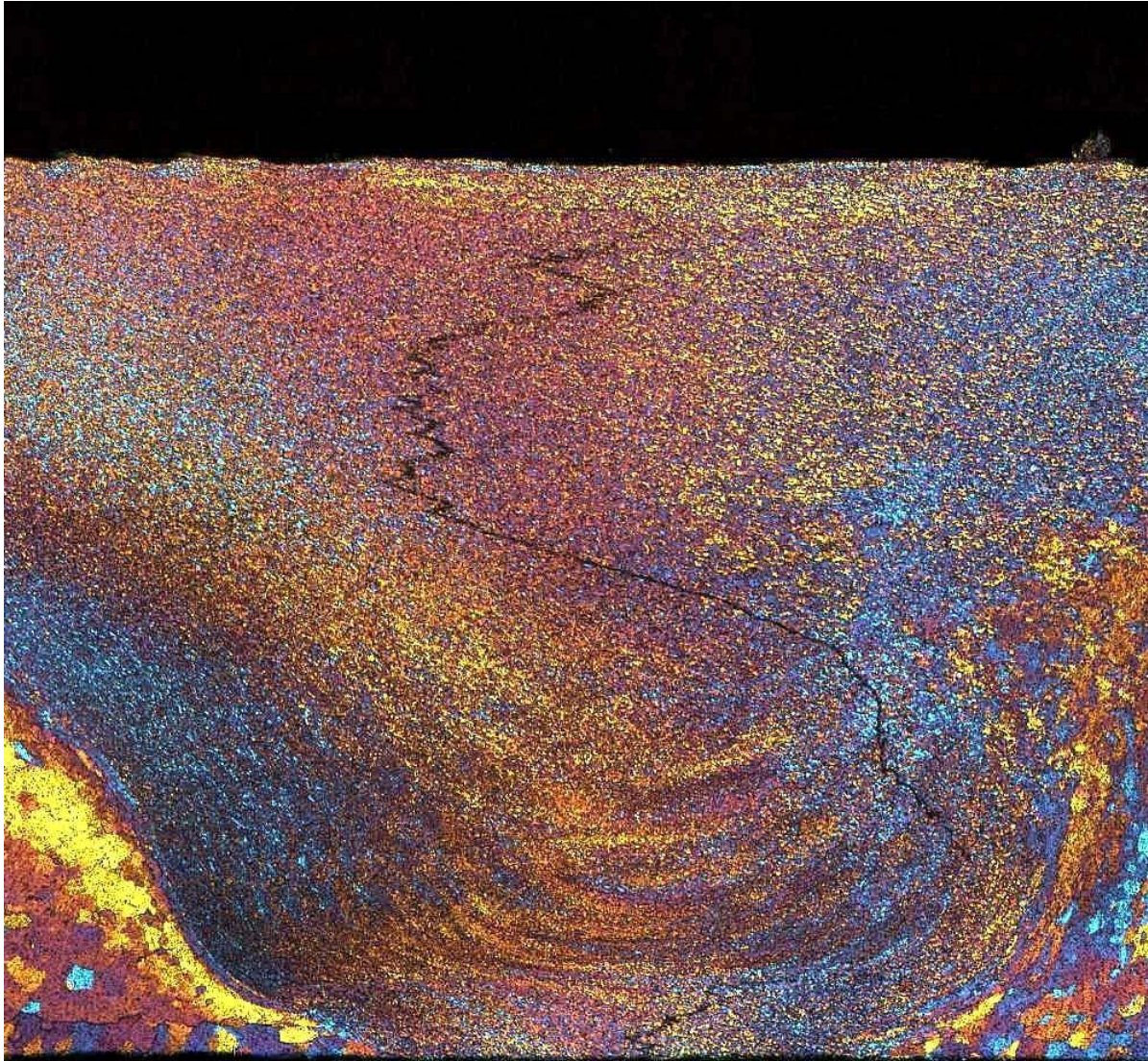
Faying surface flaw



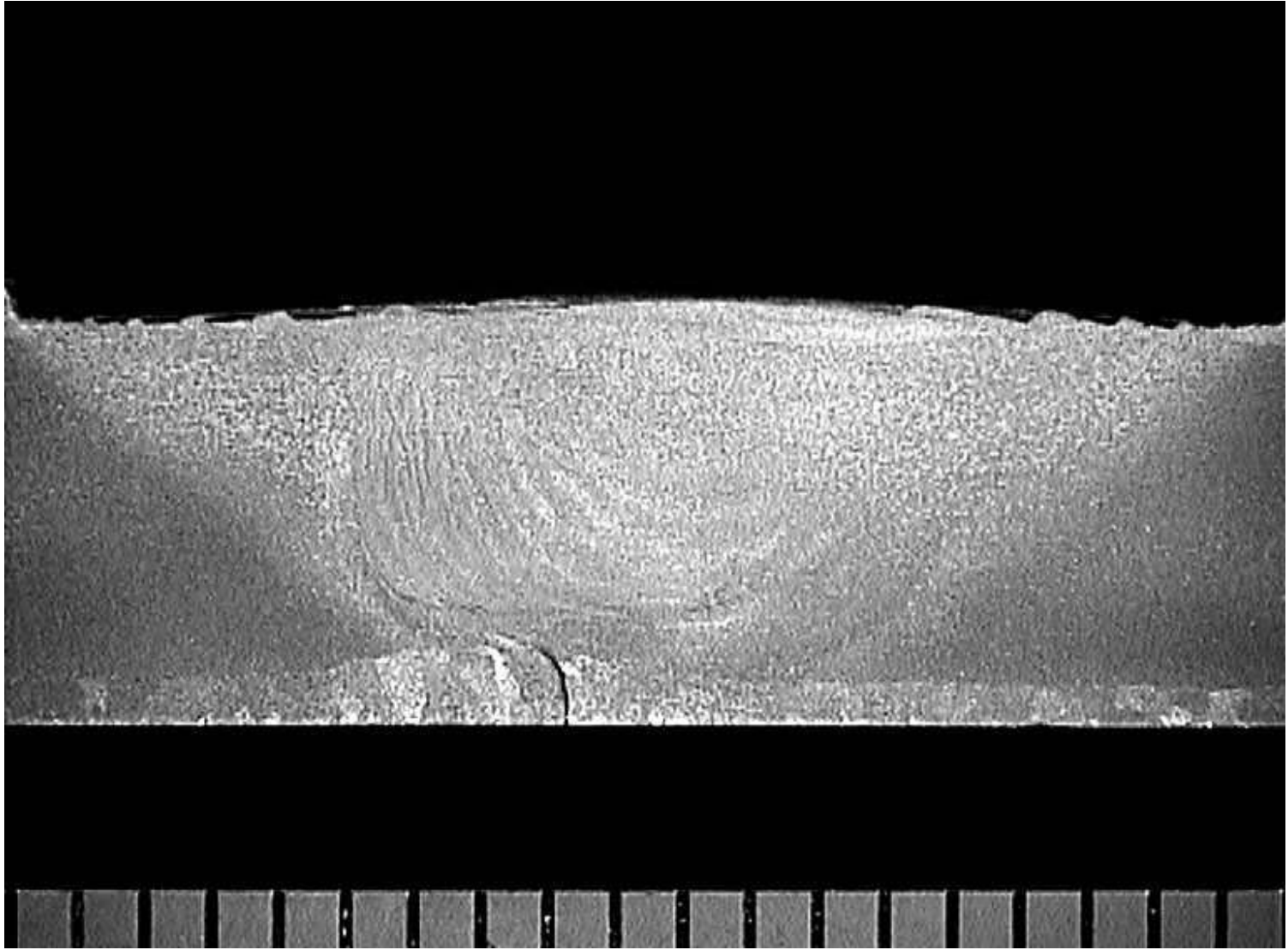




Joint line remnant (JLR)



Lack of penetration (LOP)



- **Visual inspection**
- **Liquid penetrant testing**
- **Radiographic testing**
- **Ultrasonic testing**
- **Mechanical testing (tensile/bend)**
- **Metallography**

- **Surface imperfections**
- **Geometric imperfections**
- **Voids, if open to exit hole or cut section**

- **Lack of penetration (large)**
- **Faying surface**

- **Lack of penetration (large)**
- **Voids**
- **(Faying surface)**

- **Lack of penetration**
- **Voids**
- **Conventional (single crystal) or phased array**
- **Indirect detection of root JLR/LOP**

- **Tensile test (LOP, voids)**
- **Bend test (LOP)**

- **Macrograph (LOP, voids)**
- **Micrograph (LOP, voids, JLR)**

- **Visual inspection**
- **Radiography (random spot)**
- **Bend/tensile testing**
- **Macrographs (LOP, voids)**
- **Micrographs (LOP, voids, JLR)**
- **Ultrasound (special cases)**
- **Penetrant testing (on customer demand)**