![INSTRON - The difference is measurable]

Application Note: Fracture Appearance Test (FAT)

What is FAT Test?

Fracture Appearance Testing (FAT) is a visual inspection technique used to analyze the surface characteristics of a failed component or material. By examining the fracture surface, investigators can gain valuable insights into the cause of failure, such as the type of loading, the material's microstructure, and the presence of defects

Types of Fracture Surfaces

There are three main types of fracture surfaces:

1. Ductile Fracture: Characterized by a dimpled or fibrous appearance, indicating that the material underwent plastic deformation before failure.
2. Brittle Fracture: Characterized by a flat, crystalline, or glassy appearance, indicating that the material failed without significant plastic deformation.
3. Fatigue Fracture: Characterized by a series of concentric rings or beach marks, indicating that the failure was caused by cyclic loading.

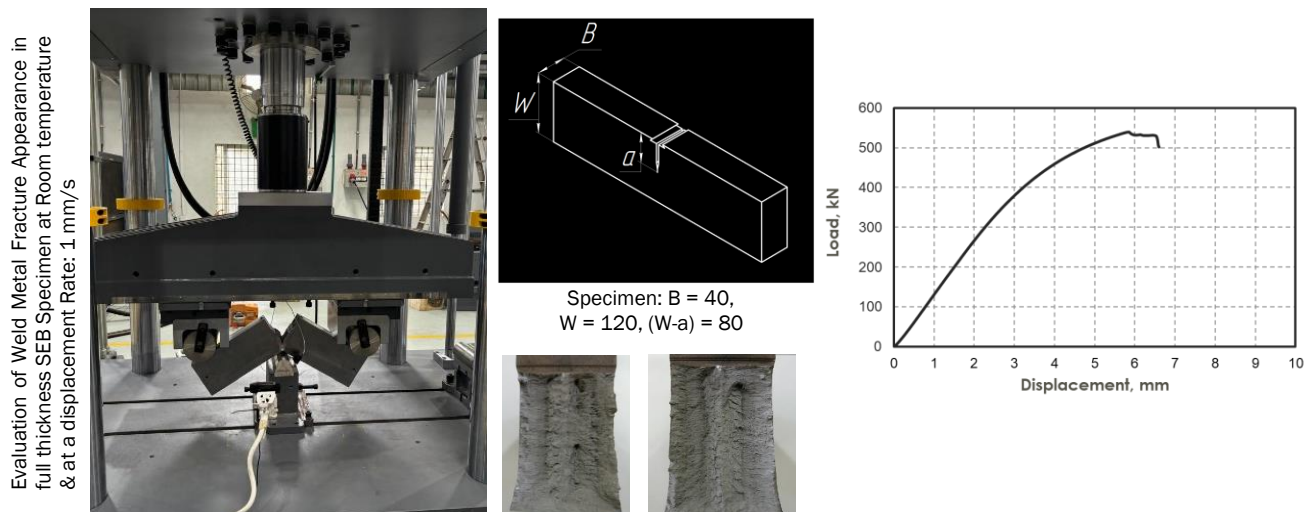### Factors Affecting Fracture Appearance

Several factors can influence the appearance of a fracture surface, including:

- Material Properties: The microstructure, composition, and mechanical properties of the material.
- Loading Conditions: The type of load (tension, compression, bending, torsion), the magnitude of the load, and the rate of loading.
- Environmental Factors: Temperature, humidity, and the presence of corrosive substances.
- Defects: The presence of defects such as cracks, voids, or inclusions.

How is FAT assessed?

1. **Visual Inspection:** The simplest method, involving a careful examination of the fracture surface using the naked eye or a magnifying glass.
2. **Microscopic Examination:** Using a metallurgical microscope or scanning electron microscope (SEM) to obtain a detailed view of the fracture surface.
3. **Fractography:** A more specialized technique that involves analyzing the fracture surface using advanced techniques such as electron microscopy, X-ray diffraction, and energy-dispersive X-ray spectroscopy (EDX).

FAT Testing with Instron Dynamic Systems

Evaluation of Weld Metal Fracture Appearance in full thickness SEB Specimen at Room temperature & at a displacement Rate: 1 mm/s

Specimen: B = 40, W = 120, (W-a) = 80

System Configuration:

BI 7035	2000kN Servo Hydraulic Dynamic Test system
AC-06-1015	2000kN Dynamic Fatigue Rated Load cell
AC-03-0090	90 LPM Hydraulic Power Unit
AC-04-2370-10	Single Station Digital Servo Controller
AC-05-01B6	FAT Fixture (up to 1200mm span)
AC-08-0005	Fracture Toughness Software Application

Instron Dynamic Systems for FAT Testing

Instron offers a wide range of dynamic testing for FAT Testing.

Model No.	Unit	BI-7000	BI-7004	BI-7020	BI-7030
Dynamic Load Capacity	kN	25	50	100-600	600-3000
Actuator Stroke (Total)	mm	50	100	150	
No. of Columns		2			4
Actuator Position		Bottom		Bottom/Top	Top
Frame Stiffness	MN/m	100	160	500/1000	2500-10000
Loadcell Accuracy		±0.3% of full scale		±0.5% of reading down to 1/500 of load cell capacity	±0.5% of reading as per ISO 7500-1
Cycling Frequency	Hz	0-65		0-100	0-35
*Column Clearance	mm	400		600	800/1000 & 1000/11200*
*Daylight Opening	mm	700	900	1200	
Electric Supply		200-240V, 15 A single Phase Supply		380/400/415 VAC, 3 Ph, 50/60 Hz	

*(Maximum Between Load Cell and Actuator at zero position)
*1000/2000 column clearance for 2000 & 3000kN systems
 Custom options available

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