IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

A LOW-COST PORTABLE DEVICE FOR EVALUATING STRETCH FORMABILITY AT VARYING TEMPERATURES AND STRAIN-PATHS

IITM Technology Available for Licensing

Problem Statement

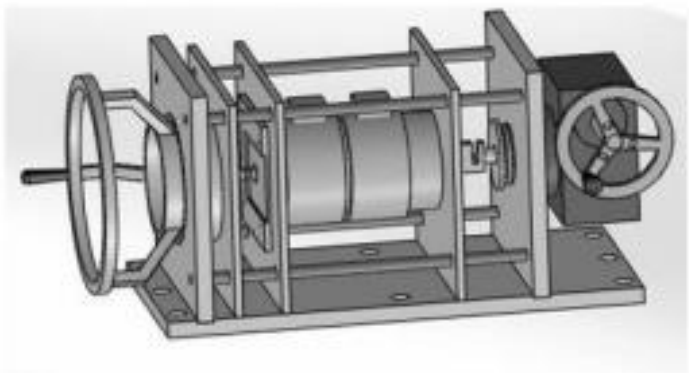
- Conventional high-temperature **stretch formability testing methods** involve expensive and bulky equipment, **hindering efficiency, especially for materials like Mg alloys.**
- There's a demand for a **low-cost, portable device** addressing these limitations and offering versatility in evaluating **stretch formability** under various strain paths **for temperature-sensitive sheet metals**.

Technology Category/ Market

Category – Material Testing Equipment
Applications – **Advanced materials**, Automotive industry, Manufacturing, Aerospace
Industry – Metal Forming and Manufacturing Industry
Market - The global Test and Measurement Equipment market size was valued at USD 31922.18 Million in 2022 and will reach USD 63925.62 Million in 2028, with a **CAGR of 12.27%** during 2022-2028

Intellectual Property

- **IITM IDF Ref. 2153**
- **IN 398673 (PATENT GRANTED)**



Technology

Electrical Resistance Heater Plate:
Utilizes advanced electrical resistance technology for precise heating during formability tests, especially at high temperatures up to 600°C.

Compact Gearbox with Worm Drive:
Features a cost-effective gearbox with a worm drive for manual operation, ensuring high precision in evaluating bi-axial and equi-biaxial strain stretch formability for thin sheets.

Versatile Sample Testing:
Capable of testing sheet metal samples with widths from 3 mm to 70 mm and thicknesses ranging from 0.2 mm to 2 mm, catering to diverse industry and research needs.

High Precision Linear Displacement Measurement:
Achieves a linear displacement measurement precision of 0.01 mm, providing accurate assessment of stretching forces applied to sheet metals.

Digital Output for Data Analysis:
Provides digital load, temperature, and linear displacement data for easy analysis, graph plotting, and integration with software systems, enabling comprehensive study of sheet metal formability under varying conditions.

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Key Features / Value Proposition

User Perspective:

- **Affordable Formability Testing:** Users appreciate a **low-cost, portable device for efficient stretch formability testing at high temperatures,** benefiting industries dealing **with temperature-sensitive sheet metals**.
- **Versatile Application:** The device's capability to **test various sheet metal sizes** and thicknesses makes it adaptable across automotive, aerospace, and research sectors, meeting diverse user needs.

Technical Perspective:

- **Innovative Heating Technology:** The use of electrical resistance technology in the **heater plate** ensures precise and controlled heating for accurate **formability testing, especially at high temperatures**.
- **Precision and Ease of Operation:** The compact gearbox with a worm drive enables manual operation **with high precision, simplifying the evaluation of bi-axial and equi-biaxial strain stretch formability for thin sheets.**

Image

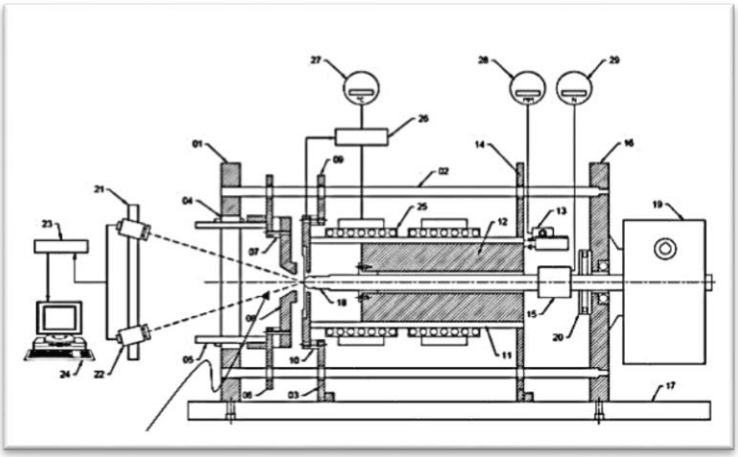

Fig. 1 shows a schematic sectional view of a low-cost portable device (100) for assessing stretch formability of sheet metals under diverse strain path conditions and temperatures.

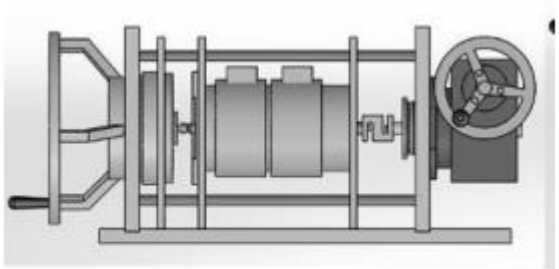

FIG. 3

FIGS. 2-4 depict graphical views of the low-cost portable device (100) assessing sheet metal stretch formability under varied strain paths and temperatures.

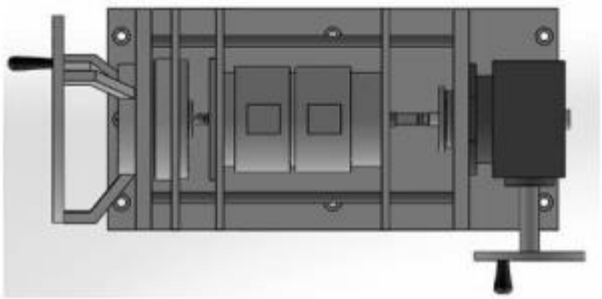

FIG. 4

TRL (Technology Readiness Level)

TRL-5, Technology validated in relevant environment

Research Lab

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Temperatures (°C)				RT	200	400	600
Sample Size	Material		Thickness	☑-Tested ☒-Not Tested			
(70 mm X 70 mm)	Al Alloys	AA1050	0.2 mm	☑	☑	☑	☒
		AA6061	0.8 mm	☑	☑	☑	☒
	Copper	CC11000	1.0 mm	☑	☑	☑	☑
	Steel	AISI1018	2.0 mm	☑	☑	☑	☑
	Mg Alloys	ZK60	1.8 mm	☒	☑	☑	☒
		AZ31	1.2 mm	☒	☑	☑	☒
	Ti Alloy	Ti6Al4V	0.7 mm	☒	☑	☑	☑
(70 mm X 10 mm)	Al Alloys	AA1050	0.2 mm	☑	☑	☑	☒
		AA6061	0.8 mm	☑	☑	☑	☒
	Mg Alloys	ZK60	1.8 mm	☒	☑	☑	☒
		AZ31	1.2 mm	☒	☑	☑	☒

- (70 mm X 70 mm) : samples for equi-biaxial stretch formability test
- (70 mm X 10 mm): samples for biaxial stretch formability test at varying strain path conditions

Table 1: Equi-biaxial and Bi-axial (varying strain paths) stretch formability test

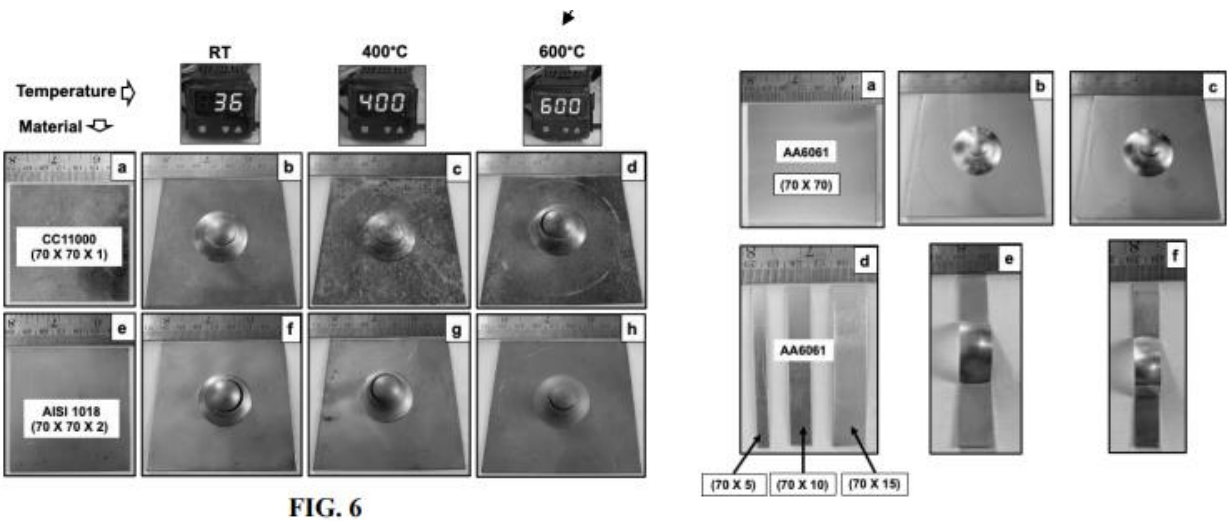

FIG. 6

FIGS. 5-8 display photographs of test results demonstrating the functionality of the low-cost portable device (100) for evaluating sheet metal stretch formability under diverse strain paths and temperatures.

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