

## MICRO-EXTRUSION APPARATUS

### IITM Technology Available for Licensing

#### PROBLEM STATEMENT

- The applicability of **miniaturized metal components** in mechanical, optical, and electrical systems has **increased immensely** in the last decade.
- In view of manufacturing bulk micro parts, **micro-extrusion is an emerging route** to produce symmetric micro parts.
- Micro-extrusion is a **subcategory of micro-forming processes** & at least one dimension of the resulting product manufactured by the micro-extrusion process **must be less than 1mm**.
- There are significant challenges in **designing high-temperature micro-extrusion apparatus**, such as **maintaining tight dimensional tolerances, reduced accuracy due to thermal expansion** in the apparatus's parts.
- There is a **need to develop** a high-precision temperature-controlled **micro-extrusion apparatus**.

#### TECHNOLOGY CATEGORY MARKET

**Category:** Advance Material & Manufacturing / Assistive, Test Equipment & Design Manufacturing

**Industry:** Manufacturing/Chemical.

**Application:** **Miniaturized metal components** used in cameras, vehicle engines, mobile phones, biomedical applications etc.

**Market:** The global market size of manufacturing to grow from **USD 68.51 Billion in 2023 to USD 121.76 Billion by 2033**, (CAGR) of **5.92%** during the projected period.

#### INTELLECTUAL PROPERTY

IITM IDF Ref. 2288; Patent No: IN 530959 ;

#### TRL (Technology Readiness Level)

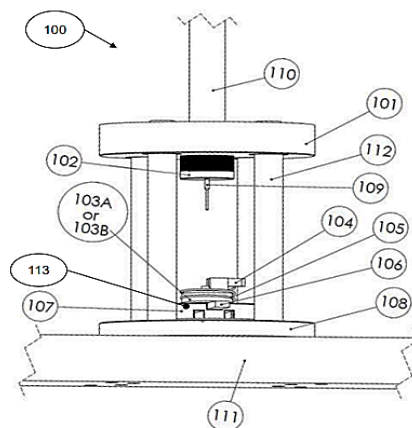
TRL-4, Technology validated in Lab;

#### Research Lab

**Prof. Sushanta Kumar Panigrahi**,  
Dept. of Mechanical Engineering, IIT Madras.

#### TECHNOLOGY

##### Apparatus



- \* 100-Micro-extrusion apparatus
- \* 101- Top plate, 108-bottom plate
- \* 102-Punch holder
- \* 103A or B-die assembly
- \* 104-Locking assembly,
- \* 105-Heating assembly
- \* 106-Sample ejection slider
- \* 107-Cooling assembly
- \* 109- Changeable punch
- \* 110- Push-pull rod
- \* 112- Guide pillars
- \* 113- Die holder

1

The micro extrusion apparatus, with a modular tool designed for micro-extrusion to accommodate **both backward and forward micro-extrusion processes** for manufacturing a micro extruded product.

2

A **die holder** is coupled to the **bottom plate** for mounting a die assembly, the die assembly comprising a billet slot for fixedly accommodating a metal billet.

3

A **punch holder** is coupled to the **top plate** for mounting a punch.

4

A **heating assembly** is configured to heat the metal billet to a pre-determined temperature. A **cooling assembly** is configured to maintain the temperature of the bottom plate and the base plate at room temperature.

#### CONTACT US

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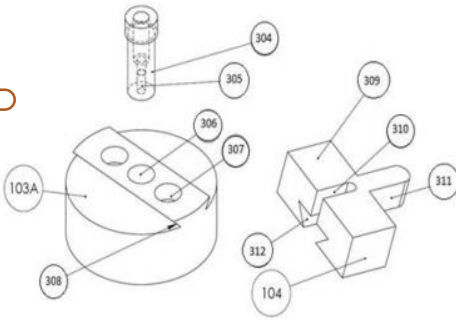
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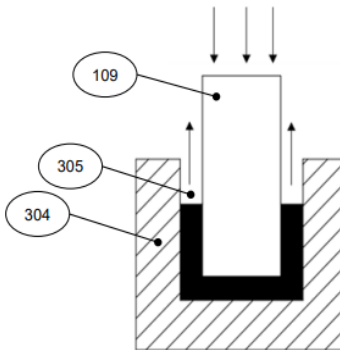
**Phone:** +91-44-2257 9756/ 9719

- ❖ The **heating assembly** heats the **metal billet** accommodated in the **billet slot** of the die assembly to the pre-determined temperature and **the punch moves into the billet slot to extrude the metal billet in the form of the micro-extruded product** and a **solid block die** is used with no scope of material leakage during the micro extrusion operation.

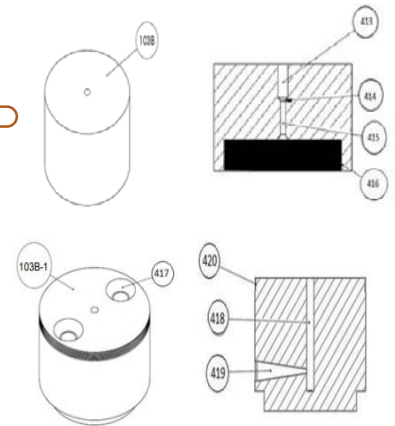
**Micro-Backward Extrusion Die Assembly**



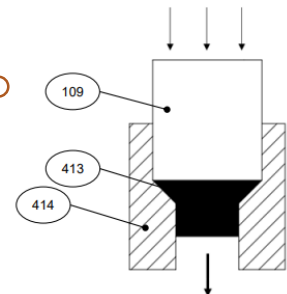
**Micro-Backward Extrusion Process**



**Micro-Forward Extrusion Die Assembly**



**Micro-Forward Extrusion Process**



### Key Features / Value Proposition

- Operated at **high temperature** upto **500° c**.
- Maintaining **tight dimensional tolerances**, optimum accuracy.
- **No gravitational pull** acting on the billet & the billet rests inside the die as the punch advances towards the billet
- **Resists thermal expansion** in the apparatus parts.
- Satisfactory **surface finish**, lesser defects, negligible thermal expansion of tool parts, close dimensional tolerances, and proper lubrication.
- **Two unique sample ejection** systems are provided **for micro backward extrusion and for micro forward extrusion**.
- Resultant product that is easier in both sample handling and sample ejection.
- Perform micro extrusion on a wide range of metallic materials including difficult to deform materials such as **Age hardenable Al alloys and Mg alloys**.
- Tool design is integrated with a cooling channel to maintain near-room temperature conditions in all other tool parts except the die. This **improves the tool's life and cost effective**.
- Capability to produce different size of **micropin and microcup** both **at room temperature and at high temperature**.

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