Micro Applications of Electromagnetic Forming

I2FG Workshop

Electromagnetic pulse forming & joining 2015, Dortmund – Germany

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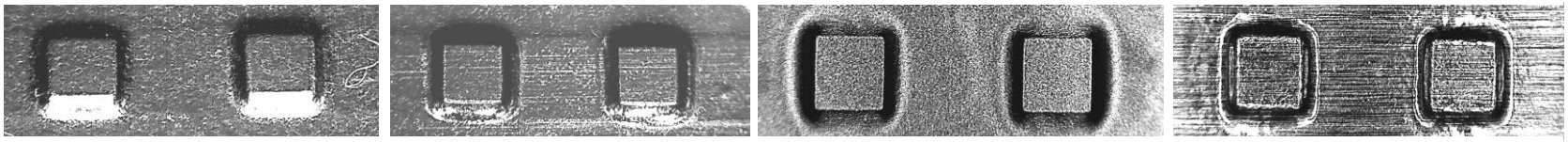


Content

- Advantages and Challenges
- Forming
- Embossing
- Cutting
- Joining
- Linked Micro Part Processing
- Summary and future work

Advantages and Challenges

Main advantages

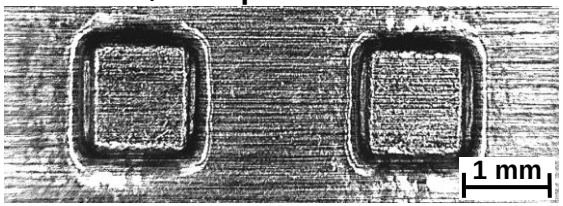
- High speed process
- Contactless working
- One tool

Challenges

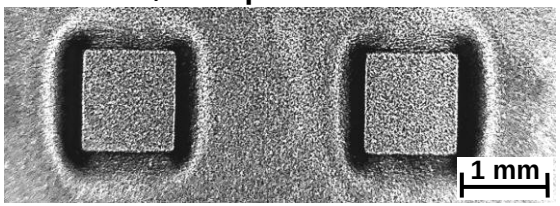
- Volume dependent forces
- Losses by diffusion
- Joule heating by induced eddy currents
- Interaction of magnetic field and workpiece
- Interaction of magnetic field and tool

Forming

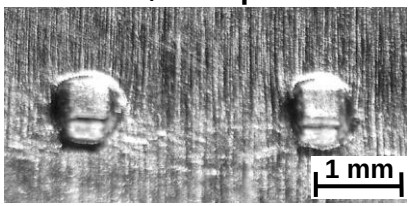
Al99.5, 50 µm



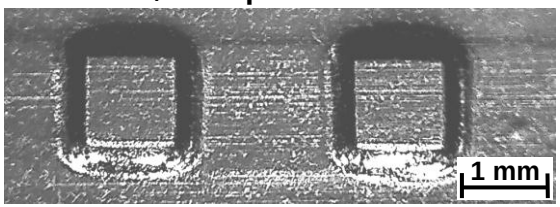
Al99.5, 10 µm



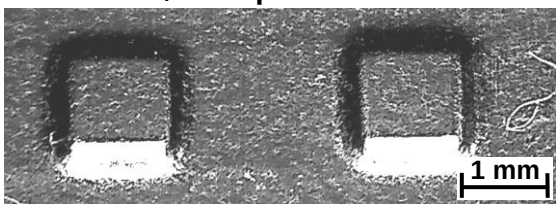
Al99.5, 50 µm



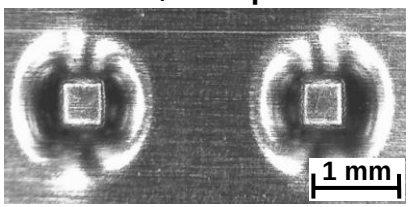
1.4301, 50 µm



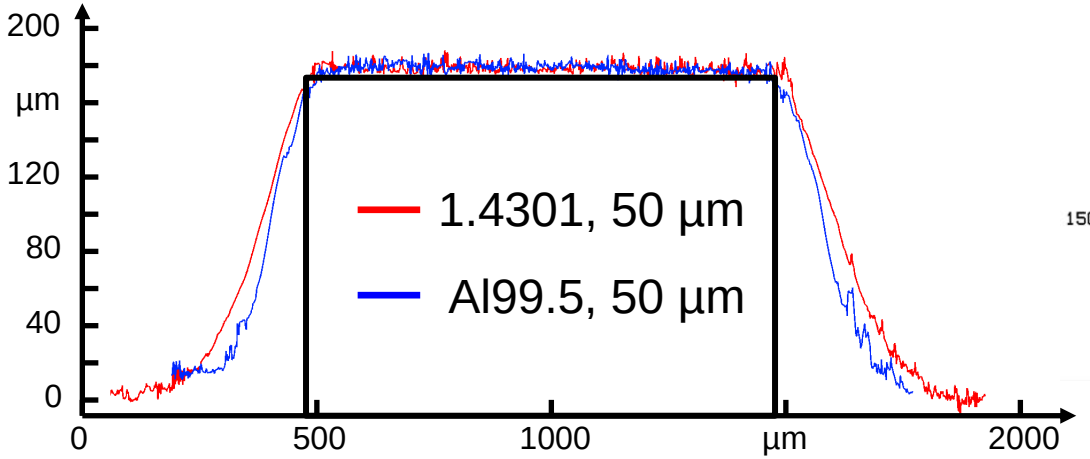
1.4301, 25 µm

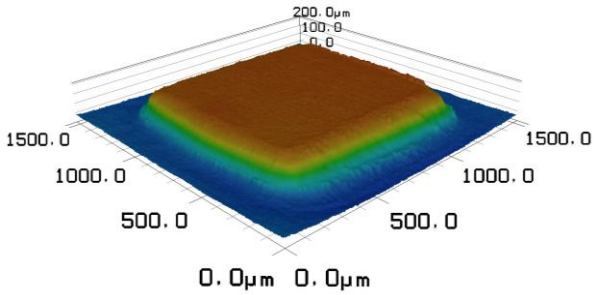


1.4301, 50 µm

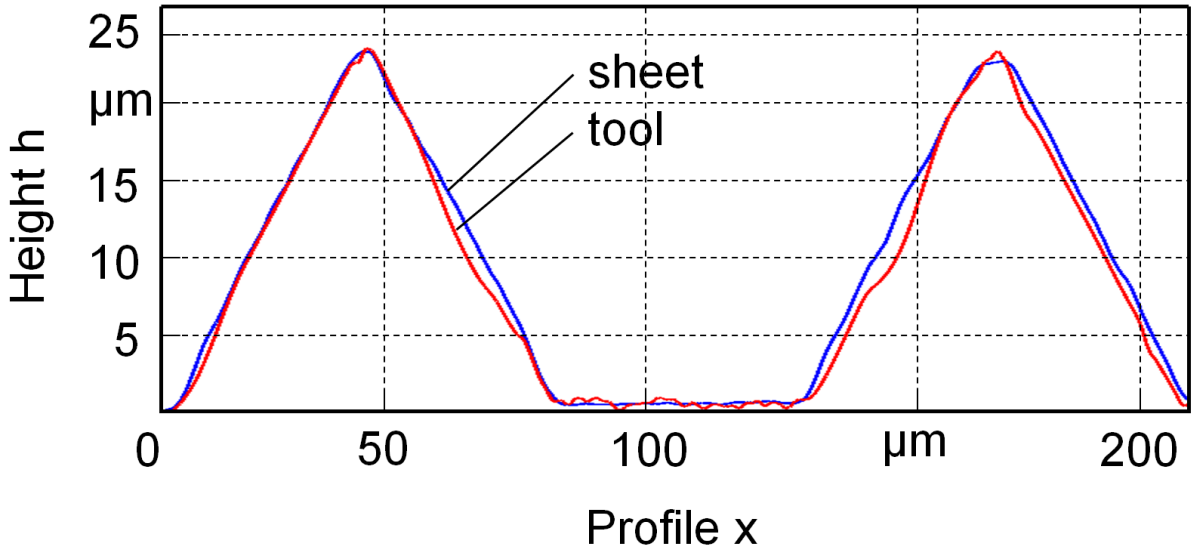


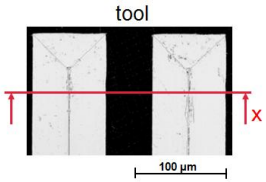
Comparison forming results

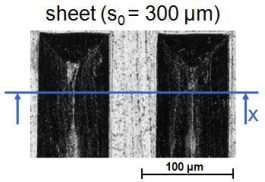


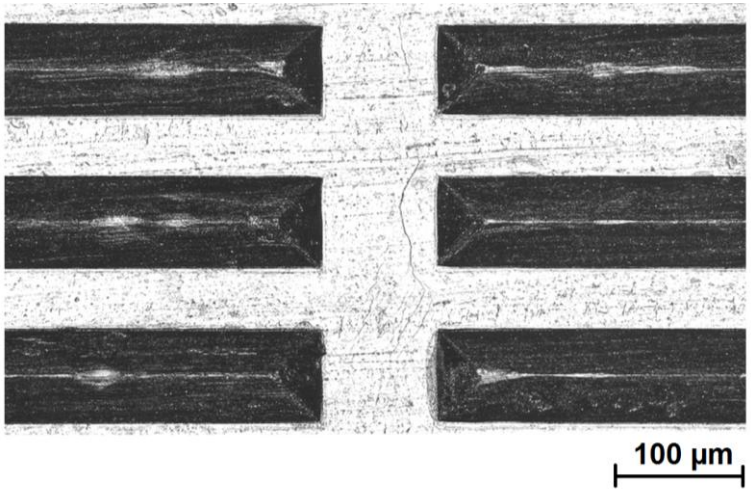


Embossing

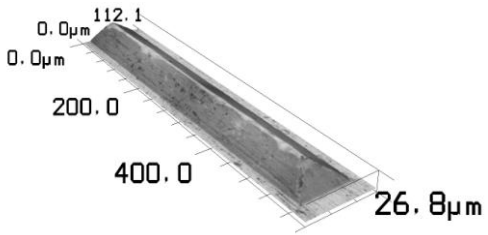








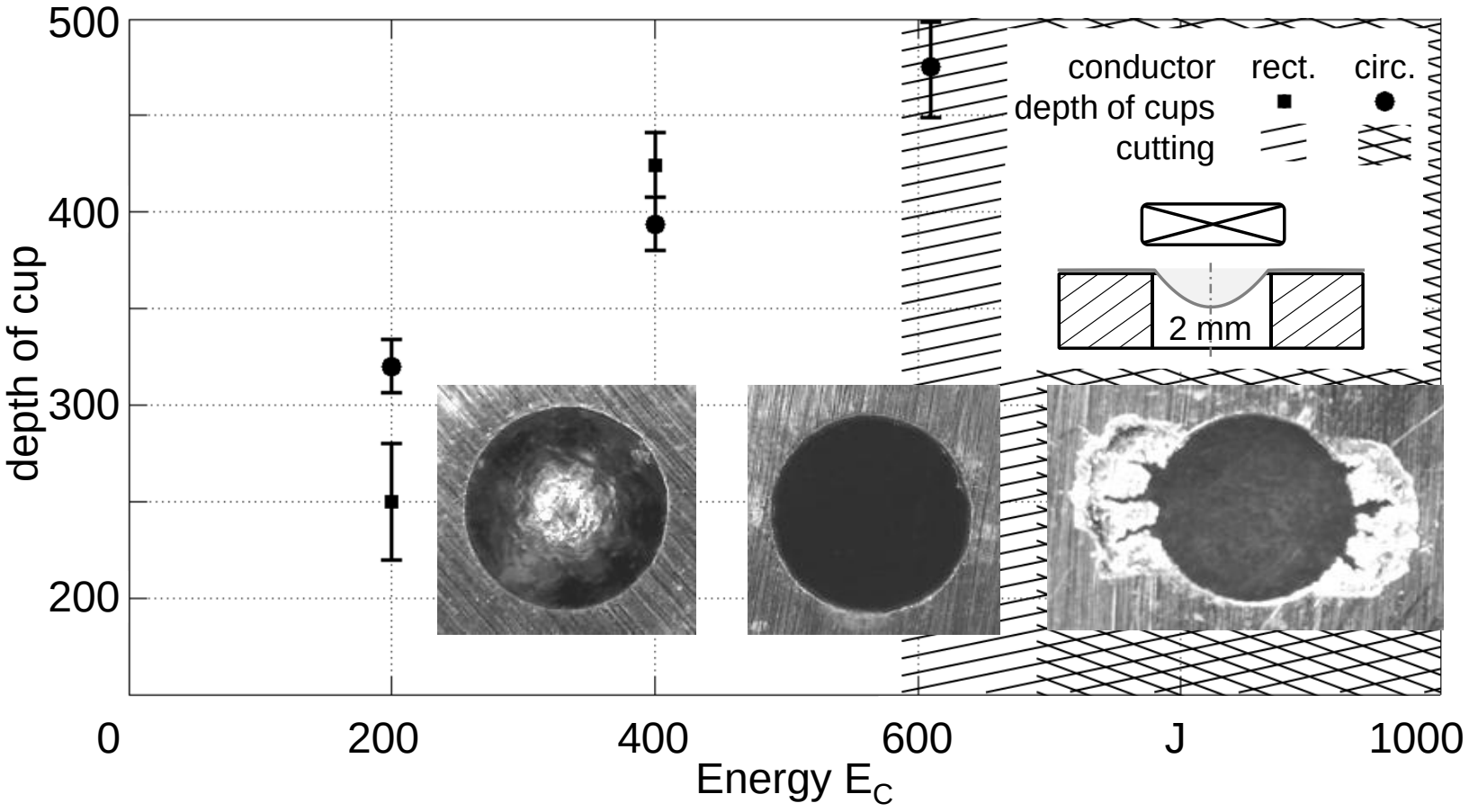
Probes initial surface
Sa = 1 µm



Tools surface
Sa = 20 nm

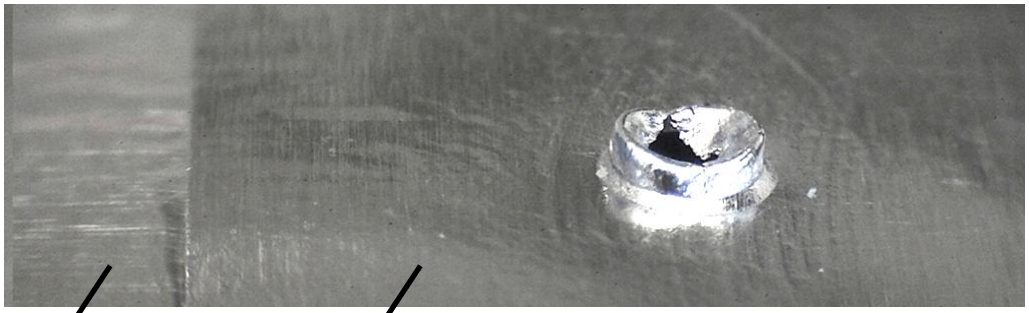
Probes embossed surface
Sa = 44 nm

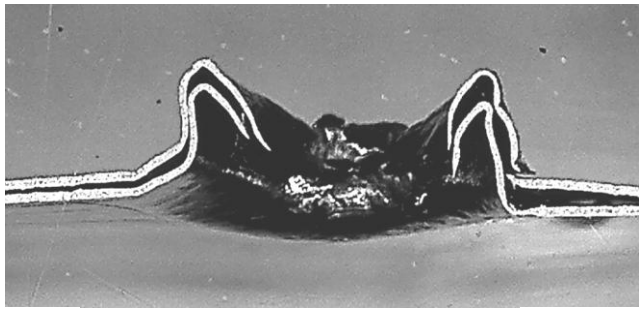
Free forming / Cutting

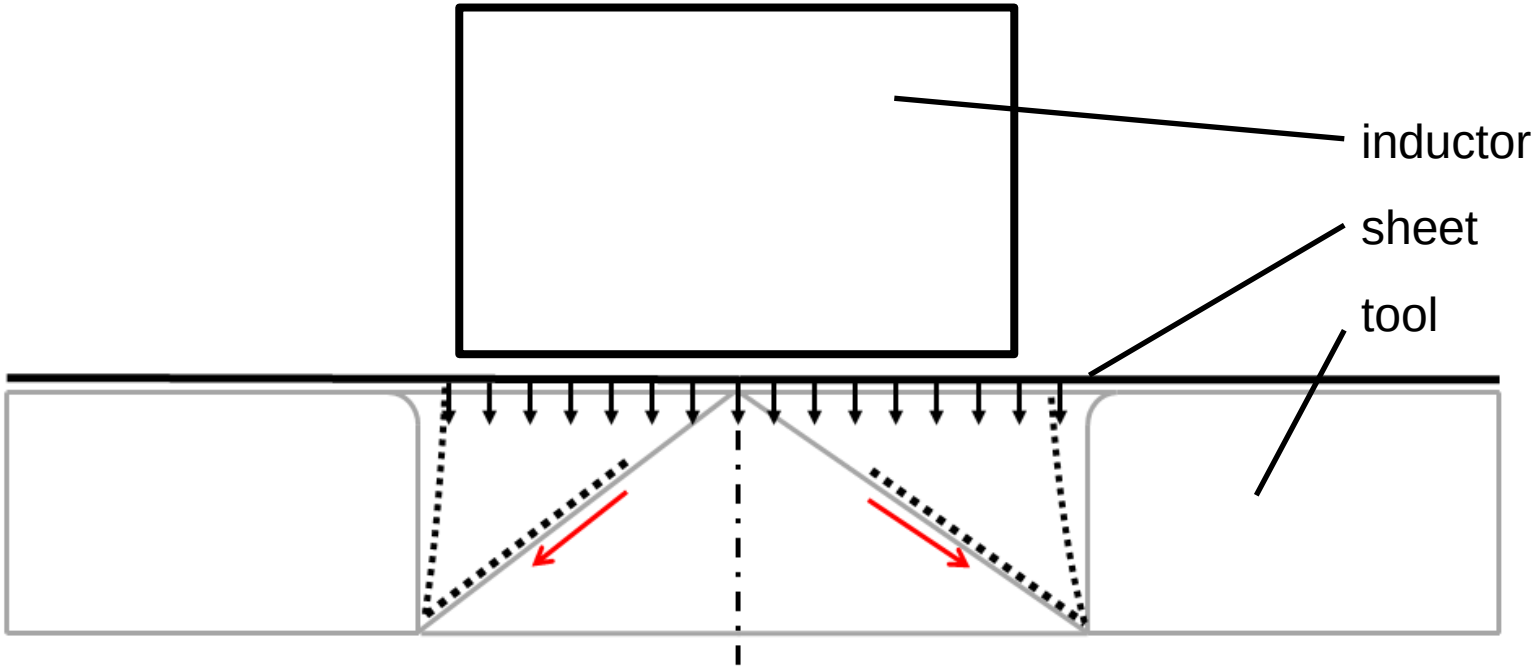


→down to 1.4 mm diameter!

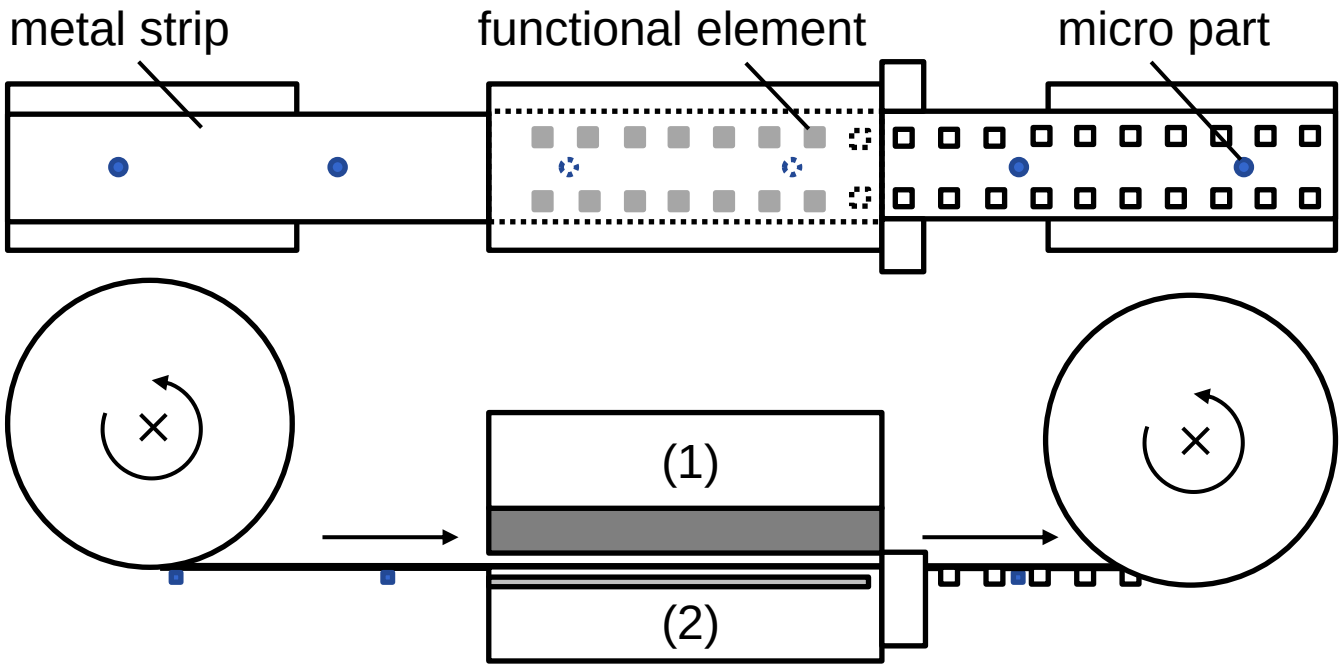
Joining by forming



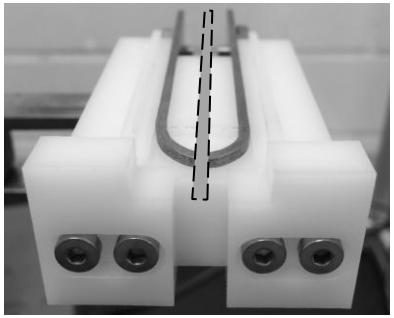




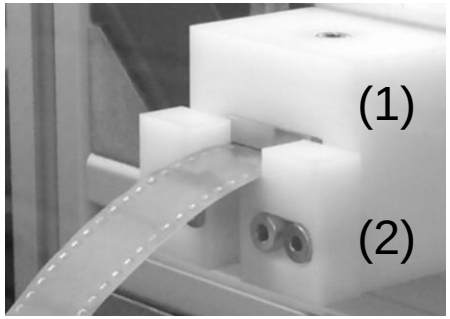
Linked micro part processing



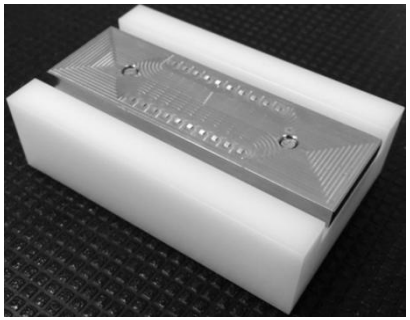
tool (2) - inductor



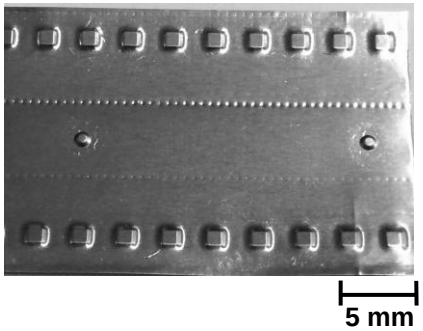
tool package



tool (1) - die



example



Summary and future work

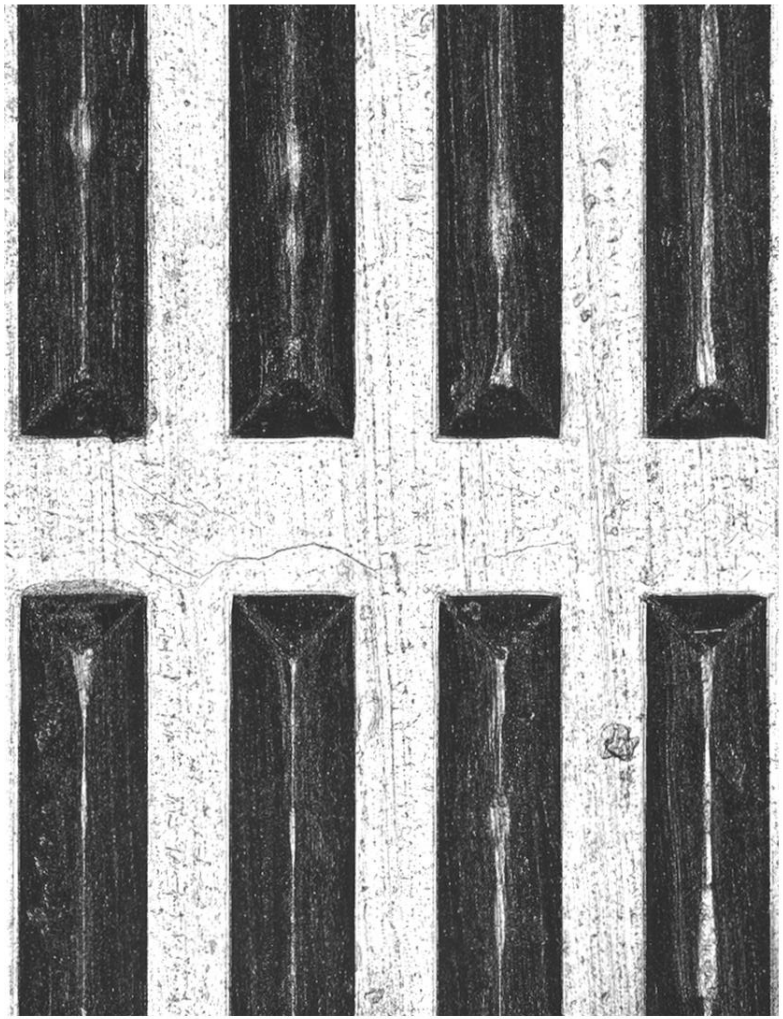
Summary

- micro manufacturing of micro metal sheets is possible
- forming, embossing, cutting and joining is possible
- very high forming accuracy e.g. by embossing possible
- challenges have to be overcome
- process combinations possible

Future work

- Investigations on interacting effects
- force measurements
- process combinations

Contact



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