

**Twenty-seventh  
Engineering Mechanics  
Symposium**

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# Twenty-seventh Engineering Mechanics Symposium

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# EFFECT OF NORMAL LOAD AND BULK STRAIN ON REAL AREA OF CONTACT IN ALUMINUM SHEET FORMING

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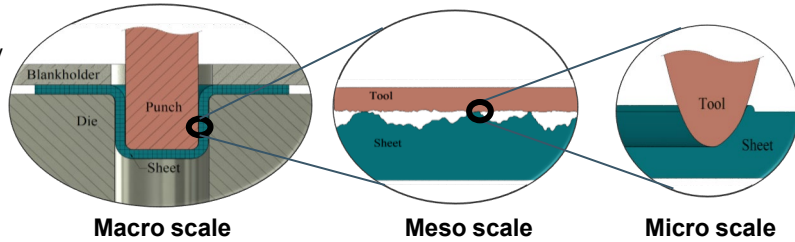
## Project Objective

Developing a **friction model** that provides **coefficient of friction** depending on the specific contact conditions.

### Contact condition

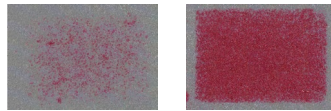
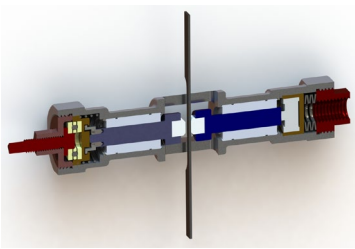
- Sheet and tool topography
- Contact pressure
- Strain
- Temperature
- Sliding velocity
- Lubricant amount

### Friction model

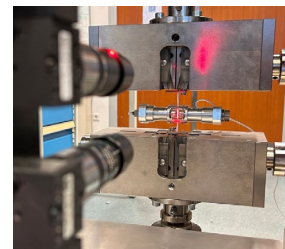


- Accurate estimation of **real area of contact** is required for predicting the coefficient of friction.
- Real area of contact changes with applying **normal load**, **bulk strain**, sliding and lubricant.

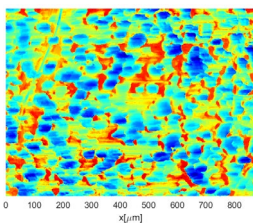
## Developing a Setup to Combine Bulk Strain and Normal Load



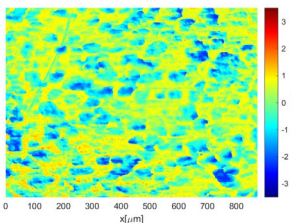
Pressure measurement films to evaluate contact pressure distribution on the surface (10 and 20 MPa pressure)



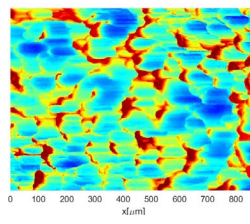
## Effect of Normal Load and Bulk Strain on the Surface Topography and Evolution of Real Area of Contact



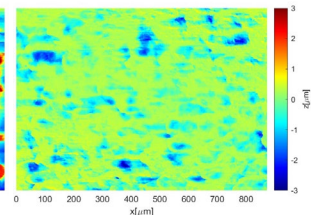
Surface topography of the undeformed sheet AA5182



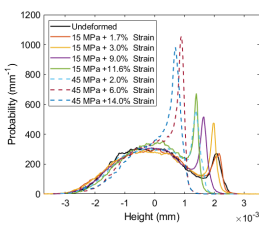
Surface topography after applying 45 MPa and 12% strain



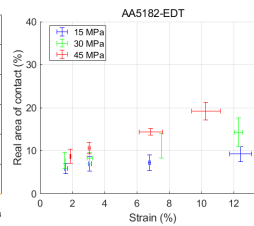
Surface topography of the undeformed sheet AA6016



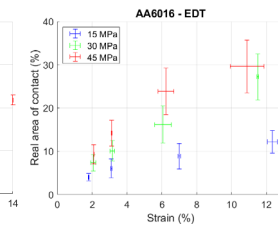
Surface topography after applying 45 MPa and 12% strain



Height probability density after different loading conditions AA5182



Real area of contact AA5182



Real area of contact AA6016

## Conclusions

- The real area of contact increases with increasing the normal load and strain.
- For higher strain values effect of normal load on flattening is more prominent.
- Results can be employed to calibrate the analytical models to predict the real area of contact.

This research was carried out as a part of the FORMALUB project.