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Year 2
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Development of Novel Coatings of Steel for the Hot-Stamping Process

Project Background

The Hot Stamping process is used mainly in the automotive industry for forming steel shapes at temperatures around 800^0C to austenize the material and prevent cracking occurring during the deforming process. The steel suffers from oxidation at such high temperatures and therefore needs to be coated to prevent this. The Coatings used currently in this process are covered under patent and are susceptible to corrosion if any damage occurs to the barrier coating. therefore development of a coating that can be used in the hot stamping process as well as provide corrosion resistance in the event of damage to the outside surface is necessary.

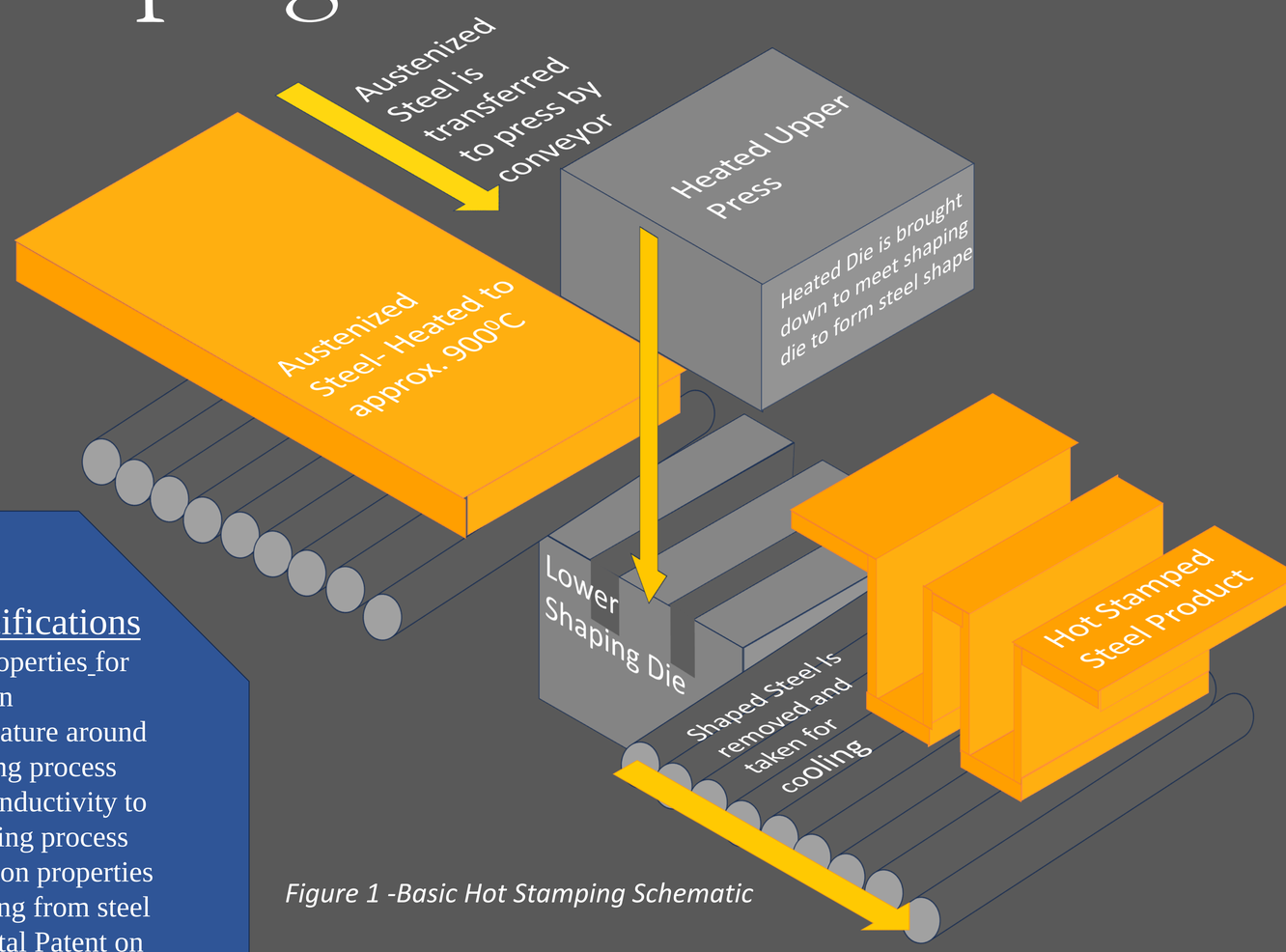

Figure 1 -Basic Hot Stamping Schematic

Fundamental Product Specifications

- Needs strong Galvanising properties for corrosion prevention
- Needs to have a service temperature around 800^0C to survive hot stamping process
- Needs to have good thermal conductivity to prevent hindrance to austenising process
- Would need to have good adhesion properties to prevent delamination of coating from steel
- Cannot infringe on Arcelor-Mittal Patent on hot stamped Al-Si Coating
- Must be an economically viable option for mass production use

Future Research Ideas

- Low temperature Galvanising- Attempting to bring down the cost through energy efficiency
- Furter alloying actions to typical galvanising coating to reduce LMIE and HE in the Steel substrate

Current Research Done

Up to date research is being conducted in Areas surrounding pre-existing zinc-based coatings focusing on the galvanising properties of 'Galfan' Based coatings with the additions of bismuth, allowing for the solidification volume change of bismuth to affect the surface finish, while also altering the Galvanising properties of the coating

Analytical and manufacturing techniques to be used

- Hot Dip simulator- to be used for simulation of the hot dip coating to create smaller scale samples for testing composition properties
- Scanning Electron Microscope- used for high magnification images of the coating microstructure as well as for identification of phases
- Scanning Vibrating Electrode Technique- used to identify areas of high electronegativity during in-situ testing of corrosion properties of chosen coatings

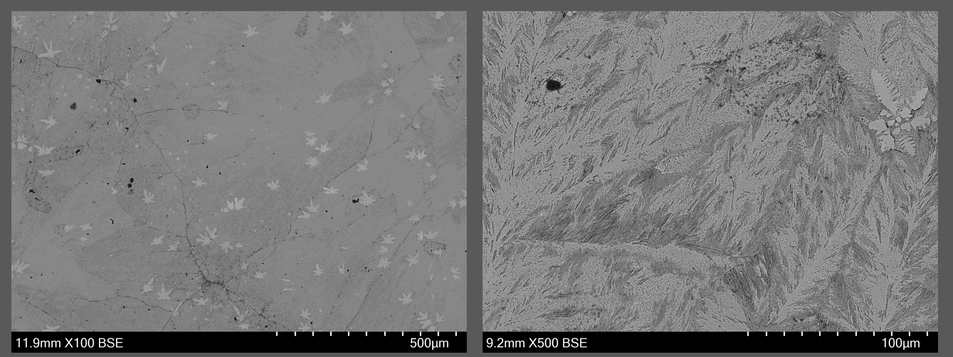

Figure 2&3 Back Scattered Electron Images of 0%Bi (left) and 1%Bi (right) Surface Microstructures at 100x

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