What is Hardfacing?

Hardfacing is a surface coating process used to improve the wear resistance and hardness of a material. It involves applying a layer of a more durable material onto a base metal to extend its lifespan and enhance its performance. This is commonly used in industrial applications where parts are exposed to high wear, abrasion, and impact. The process can be done using various methods such as welding and thermal spraying. In our case, we used thermal spraying with an oxy-acetylene torch to apply a nickel-based alloy coating.

My Work on Hardfacing for Ahresty and Coperion

For these customers, we performed hardfacing on cylindrical parts for Ahresty and Coperion to enhance their durability and hardness. The base material was a relatively inexpensive metal, and we applied Colmonoy 69, a nickel-based powder known for its high wear resistance.

Process Overview:

1. **Preparation** – The cylindrical parts were properly cleaned using acetone and steel-shot grit blasting.
2. **Cobot Programming** – I programmed a Doosan cobot to automate the spraying process, ensuring uniform and precise coverage.
3. **Thermal Spraying** – Using an oxy-acetylene torch, we heated and sprayed Colmonoy 69 onto the surface of the parts while they were rotated on a lathe (and the co-bot moving across the lathe) for even coating.
4. **Furnace Hardening** – After spraying, the coated parts were placed in a furnace for heat treatment to enhance hardness and bonding.
5. **Cooling and Inspection** – After furnace treatment, the parts were allowed to cool, and we inspected the coating for consistency, adhesion, and hardness.

Struggles Encountered:

One major challenge we faced during the process was **oxidation**, which affected the overall quality of the coating. Initially, our oxy-acetylene torch was not set to a **neutral flame**, meaning there was an excess of oxygen in the flame. This caused oxidation of the molten Colmonoy 69 particles before they could properly bond with the base metal. Excess oxidation led to a weaker, less uniform coating with reduced durability.

To resolve this, we adjusted the flame settings to achieve a proper neutral flame, ensuring the right balance of oxygen and acetylene.

Another issue we encountered was **cracking after furnace hardening**. Some coated parts developed cracks after heat treatment, likely due to an uneven coating and a number of things. To mitigate this, we experimented with many different programs and it took very many trials and errors over time to correct this issue.

Key Achievements:

- Successfully applied a durable hardfacing layer that enhances wear resistance.
- Automated the process by integrating the Doosan cobot, increasing efficiency and reducing human error.
- Improved consistency in coating thickness by synchronizing the cobot and lathe rotation.
- Optimized flame settings to minimize oxidation, leading to better adhesion and coating quality.
- Enhanced hardness through furnace treatment while troubleshooting oxidation and cracking issues.
- Demonstrated strong problem-solving and technical skills by programming the cobot and refining the spraying and heat treatment process.