**Laser Hardening of Grey Cast Iron using a High Power Diode Laser**

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**The Process**
- Thermal hardening process where high intensity laser radiation heats the workpiece surface above a critical transformation temperature

**Heat transfer solution:**
- Finite element method used to solve (ABAQUS)
- Rapid cooling by conduction causes self-quenching to form hard martensite on surface

**Thermodynamic modeling**
- **Aim:** To create a tool for predicting the outputs from the laser hardening process using a high power diode laser, for a given set of input parameters
- **Heat transfer problem:**
  - Heat flow in 3 dimensions
  - Moving heat source
  - Variable thermal properties
  - Transient heat conduction

**Experimental Work**
- **Aim:** To validate the thermal model and to determine the link between wear resistance of the hardened surface and its material properties
- Samples of cast iron laser hardened using a range of processing conditions and output characteristics such as hardness profile measured

**Fig. 1 Schematic of laser hardening process**

**Fig. 2 Interaction time vs. irradiance for a number of common laser applications**

**Fig. 3 Visualisation of FEM model using ABAQUS software**

**Fig. 4 High power diode laser hardening at UCD**

**Fig. 5 Typical plot of hardness vs. hardened depth in laser hardening of cast iron**