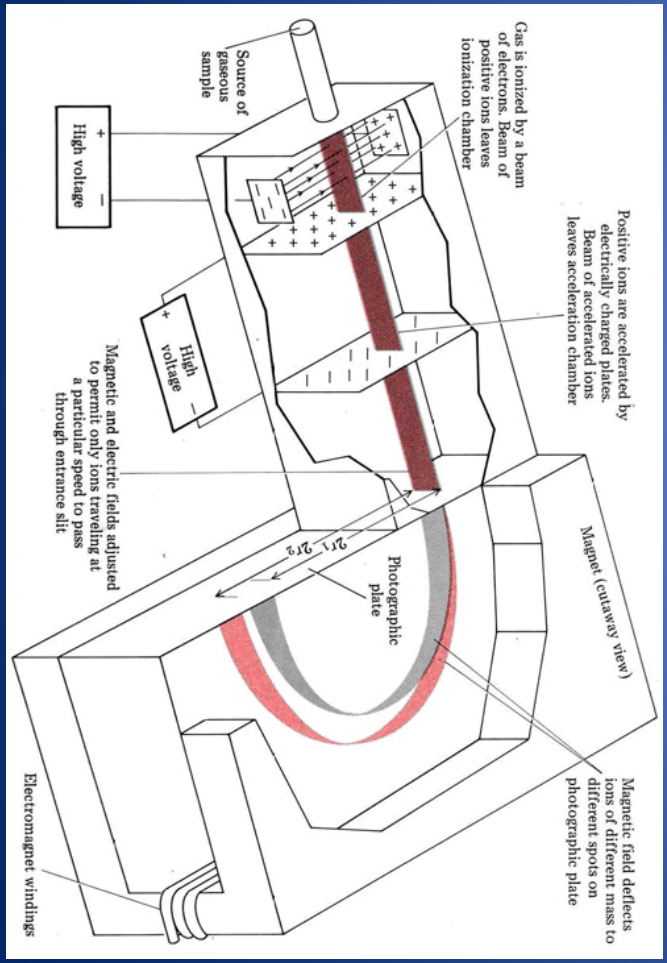
Team 5: Steelmaking Project Solutions

Solid vs. Molten Analysis

- Solid sorting techniques tend to be cheaper, easy to implement, and more compatible with the current steelmaking process, but such testing is prone to errors and ‘probable scenarios’

- Molten analysis allows a much more exact chemical science to take place, albeit one that’s likely to be far more difficult to implement. The scrap provided must first be melted down and then likely tested in a multi-step, multi-chambered contraption that remove undesired alloys.

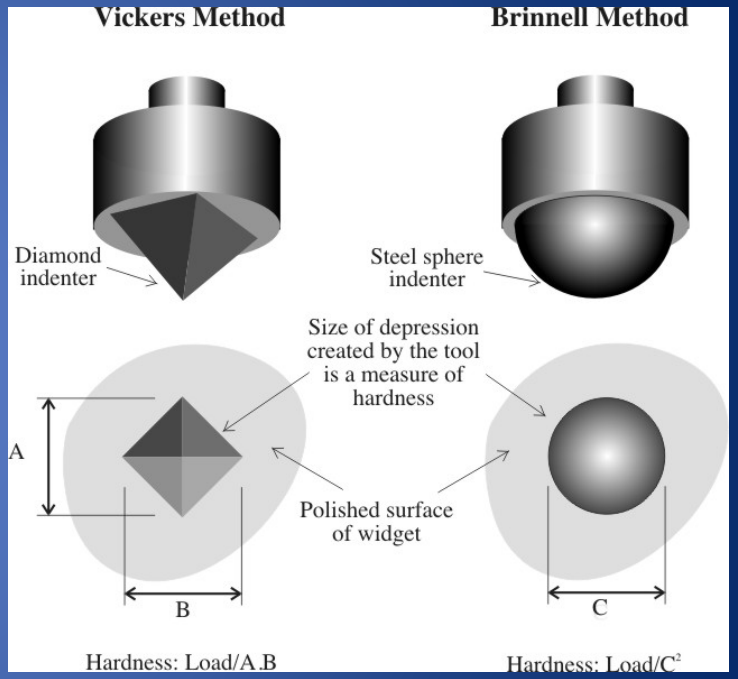
Solid: Conductivity



- Borne of the idea of a Mass Spectrometer
- A charged plate would transfer a set amount of charge to a single chunk of alloy material, depending on the conductivity of the material.
- This would then be dropped down a vertical shaft under the influence of an extremely powerful magnetic field.
- The charged nature of the steel would cause its trajectory to bend more or less, depending on the contents, allowing for a sorting mechanism to develop.

Solid: Hardness Testing

- Melt material into small slabs
- Perform hardness test on material
- Compare results to the hardness of advanced high strength steel
- Separate materials with similar hardness to AHSS from other materials

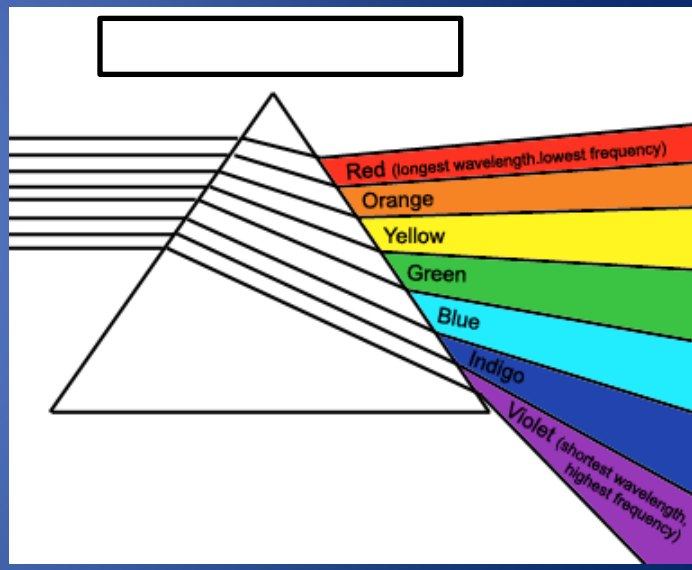


Solid/Molten: Spectroscope analysis

- Heat up metal samples
- When heated, each element emits a certain wavelength of light
- Hot Body Radiation

- View sample with a spectroscope

- We can use spectroscopy to determine exactly which element is in the sample by observing wavelength, and how much of each element is present by observing the intensity of the present wavelengths



Molten: The Use of Chemical Reactions

- Refine the chemical process used in steel making
- Alter the reactions to yield new, more desirable products.
  - Using different chemicals and reagents can help in separate the AHSS.
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- Decarburization

$2C + O_2 \rightarrow 2CO$ (reaction occurs in bath, CO to off gas)

$2CO + O_2 \rightarrow 2CO_2$ (reaction occurs above bath, CO_2 to off gas)

- Silicon Oxidation

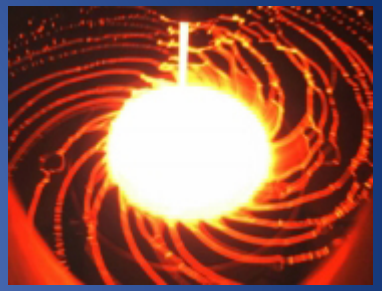
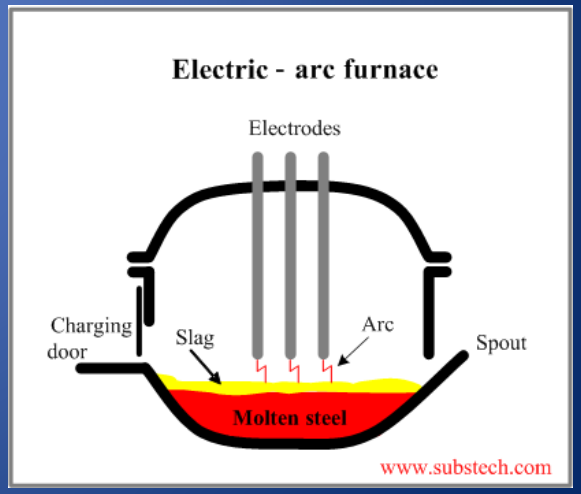
$Si + O_2 \rightarrow SiO_2$ (reaction occurs in bath, SiO_2 to slag)

- Manganese Oxidation

$Mn + O_2 \rightarrow MnO$

- Aluminum Oxidation

$4Al + 3O_2 \rightarrow 2Al_2O_3$ + HEAT!

Molten: Multi-Step Chemical Analysis

- Attempts to create Slag-runoff type material according to each of the major problem elements in a pre-steelmaking process, producing major elements of CO2 from the carbon and various other separable species of alloy compounds.
- The 'off-chemistry' steel problem is mitigated by the fact that we are providing low-density steel to the final steelmaking 'pot' of sorts.