Discussion on Issue of Gas Injection in Rotary Kilns (RK)

The conversation discussed the challenges and potential solutions for gas injection in rotary kilns, focusing on the kinetics of the reduction process:

1. Kinetics of Gas-Solid Reduction: One participant emphasizes the need to understand the kinetics of the reduction process in a rotary kiln, which involves gas-solid phase reactions. The complexity of the rotary kiln environment requires careful consideration of these dynamics.

2. CO2 Reduction and Residence Time: Another participant acknowledges the innovation of Prof. Brahma Deo's idea but notes that its success in reducing CO2 will depend on the actual residence time of the gas compared to the gas-solid reaction time, as pointed out by Shri Singhania.

3. Practical Experience: A participant shares their personal experience, stating that similar attempts were made in their mini VSK plant, but the residence time in a rotary kiln is insufficient to complete the reduction process.

4. Reverse Engineering and Existing Solutions: A participant suggests that reverse engineering the existing gas injection systems used in DRI could be helpful. Referring to the Allis Chalmer design, this could be a useful starting point for further experimentation.

5. Fundamental Studies: Another participant from IISc expresses the need for fundamental studies to better understand the process.

6. Ported Kiln Experience: A participant and their team offered their expertise in ported kilns, mentioning that they have previously installed ported kilns across India.

7. Existing Systems and Improvements: One participant mentions the ACCAR process, modified by OSIL for coal injection, which is currently used at several plants like Tata Steel Gamharia and Super Smelter. To improve gas-solid contact, they suggest increasing the dam height in the system.

The discussion highlights the need for further research and practical experimentation to optimize gas injection in rotary kilns, with contributions from various experts in the field.

8. A participant Outlined the Following Points:

i. CO2 Emission Comparison: There is a need to compare the CO2 emissions per ton of liquid steel produced via the DRI route versus steel produced using the blast furnace (BF) or other processes.

ii. Trial for Gas Efficiency: Tata Sponge Gamharia is advised to conduct a trial using gas to assess its efficiency in reducing coal consumption. OSIL has not yet tried using gas, as it was not available, but they have used HSD (High-Speed Diesel) in the ported kiln for over a year in 1983-84 without any technical issues. The overall goal is to evaluate the efficiency of gas use in the DRI process and to compare CO2 emissions between different steel production methods.

Prof. Brahma Deo suggested that one possible application of gas in the DRI process could be to accelerate the preheating of the charge at the feed end of the rotary kiln. By calculating the optimum heat supply rate, it is possible to balance the heat input with the material's heat absorption. This would allow the material to reach temperatures of 850°C or higher in the shortest time possible, thereby reducing the total reduction time and ultimately decreasing coal consumption.

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