Inert Electrode Shielding

Dear *I & SM*:

We have to reduce the nitrogen pick up in our steelmelting shop.
1) Can you help us please to find out conference proceedings or paper to apply new technology to lower the nitrogen pick up at our plant.
2)Could you evaulate the following suggestion to lower the nitrogen pick up in ladle furnace please.

Since steel picks up nitrogen during tapping, stirring and casting the nitrogen solubility in the liquid steel increases continuously in the steelmaking shops. In an EAF melting scrap in the open air, nitrogen solubility is getting higher because of ionization of the air at the electrode tips.

In my opinion, EAF and Ladle Furnaces work in the same principle. I think In ladle furnace , while the temperature of steel increases during the arc time steel picks up nitrogen higher in the course of time because of ionization of the air at the electrode tips too. If we exist positive Ar gas pressure throughout the ladle surface area parallel to the slag or vertical to the graphit electrode by means of "O" ring mounted the water cooled roof and remove the air from that area we can prevent steel's nitrogen pick up coming from ionization of the air at the electrode tips. Blowing of Ar gas by lots of holes on"O" ring must be started up a few minutes ago before the ladle metallurgıcal process is started and continued during process by means of PLC (Programming Logic Control) system automatically. Ar gas pressure is enough to reach the centre of ladle surface area. These events are illustrated in the following figure.

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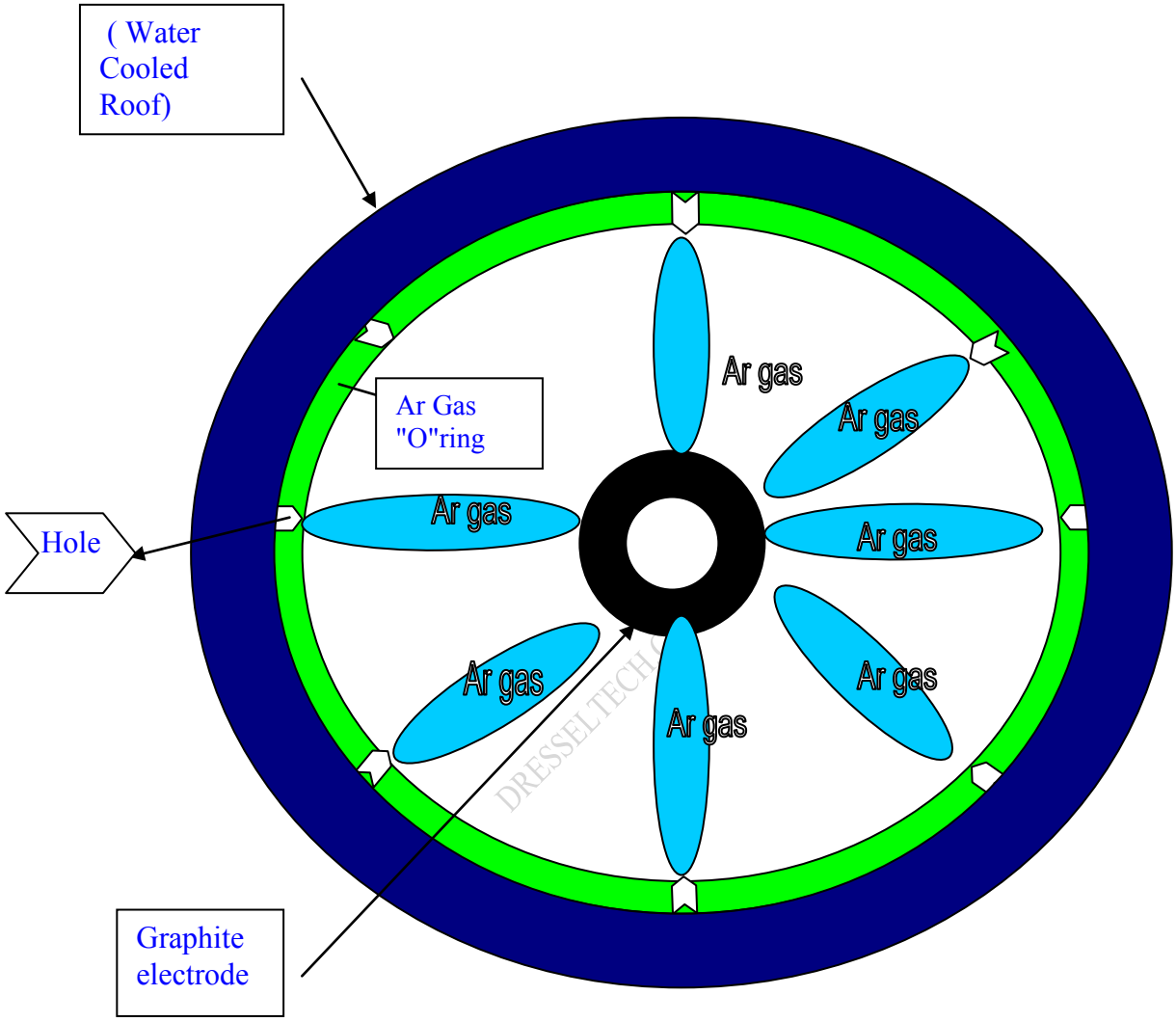

This figure shows cross-section of the "O"ring with Ar gas blowing mounted to the water cooled roof .

LMU, Turkey

Dear LMU,

There are a number of conditions that may occur during the steelmaking process which can result in nitrogen absorption in the melt. You have correctly identified a major contributor, that is ionization of nitrogen gas by the electric arc and

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subsequent reaction with the molten bath. In addition, your assessment that the mechanism works in both the EAF and LMF equally true.

Modern EAF practices have reduced nitrogen pick up by gas-arc reaction (although certainly not eliminated it). This has been accomplished by improved slag foaming, shortening heat times, adding high levels of carbon, gas injection and in some cases DRI additions. These procedures are not as common in the LMF, in addition air ingress is significant. You have suggested injecting argon around the roof ring to inert the electrode area. Although total inerting of the area with argon will achieve the intended purpose, there are some technical and economic issues with doing this. First, unless the roof is extremely well sealed, the injectors will act as pumps and likely draw air in to mix with the argon, thus inhibiting the inerting process. Second, the volume and cost of argon will be substantial.

Over the years hollow or drilled electrodes have been tested whereby argon is injected down the center hole which has met with some success, although the cost of coring electrodes is high. Nitrogen pick up continues to be a problem in the LMF and a good slag practice and minimizing the processing time are critical issues.

This answer was contributed by Ken Grieshaber of B.O.C. Gases who can be contacted at Ken.Grieshaber@us.gases.boc.com

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