PLUGGING INDICATOR - MEASUREMENT OF LOW IMPURITY CONCENTRATIONS AT A CONSTANT ORIFICE TEMPERATURE

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INTRODUCTION

Plugging indicators have been used extensively to measure impurity concentrations in liquid sodium systems. Simplicity of design, installation and operation is the most commonly quoted advantage. If there is no problem when the plugging temperature is important, it is more difficult to measure a plugging temperature when the impurity concentration is low. Then, the plugging temperature is often reported as inferior to 110 °C. This measurement is sufficient for the technicien. Sometimes, however, a more precise indication is required in cases where the implantation either an oxygenmeter or a hydrogenmeter is impossible. We propose a use for plugging indicator which satisfies this type of requirement.

PRINCIPLE OF THE PLUGGING INDICATOR

The plugging indicator shown in Fig. 1 is the most commonly used in France. It is often the only on-line monitoring system. In this apparatus, the sodium flows in the outer annulus and cools the sodium flowing out the center tube. The plugging indicator is cooled by blowing gas (often air) and electrically heated. The orifice ring is situated at the end of the annulus, near a thermocouple.

In parallel with this apparatus, there is a special device, shown in Fig. 2, and called "constant pressure drop system". The pressure drop of this device is independent of the flow rate within a certain range. So this system is used to maintain the flow through the plugging indicator independent of the flow variations on the other parts of a sodium loop.

H. U. Borgstedt (ed.), Material Behavior and Physical Chemistry in Liquid Metal Systems
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The plugging indicator is equipped with an automatic control system. So, the temperature of the orifice ring decreases at a given and constant rate until a restricted flow corresponding to a given ratio of the initial flow. Reheating is then started. The temperature when the sodium flow begins to decrease is the plugging temperature. It is possible also to held the temperature constant at a given value as shown on the Fig. 3.

The analytical model which describes the evolution of a plug, has been explained in details (4). Let us remember the main assumptions: