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Conventional resin cation exchangers versus EDI for CACE measurement in power plants – Feasibility and practical field results

Manuel Sigrist

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1. Introduction

The operator of a sampling system has the task of monitoring the ion concentration in the reactor condenser hotwell. In order to provide reliable monitoring, all of which greatly facilitate the operation and permanent sample flow monitoring, the operator of the sampling system has the task of monitoring the ion concentration in the reactor condenser hotwell.

2. Problem description

Accuracy is the most important parameter for any CACE measurement in power plants. In order to be able to fulfill all required conditions the CACE measurement configuration has to provide determination capability, which can be done with the reference equipment such as the well-known ion-selective electrode technology (CACE). The reference equipment and the reference type with 1 l resin as reference are still leaching and causing a permanent sample flow monitoring system.

3. Case study: Feasibility and practical field results

The next chapter describes some of the field data collected during these early project phases and demonstrates the contribution of the new CACE instrument used in power plants. The CACE instrument was designed specifically for use in power plants.

4. Conclusion

In conclusion, this paper presents the results of a comparative study between a conventional cation exchanger (CACE) and an ion-selective electrode (ISE) for CACE measurement. The results show that the CACE instrument is suitable for power plant applications and can be an effective alternative to ISE technology. Further research is needed to investigate the long-term performance of the CACE instrument and to evaluate its suitability for different types of power plants.
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Die Leitfähigkeitsmessung nach einem Katio-
vern versus EDI for CACE measurement

Problem description

Conventional resin exchange methods involve the use of cation exchange resin in a vessel, which is operated for a period of time. After this exchange, the resin is removed and new resin is added. This process can be repeated multiple times.

Conventional resin exchange methods have limitations, such as:

- Limited capacity of the exchange resin:
  - New resin is required after a certain number of exchanges.

- Time-consuming and labor-intensive:
  - The exchange process requires manual handling of resin and equipment.

- Possibility of resin loss:
  - Resin particles may be lost during the exchange process.

- Inconsistent results:
  - The results of the analysis may vary depending on the operator.

Conventional resin exchange methods are not suitable for continuous operation in power plants.

Solution

AMI CACE is an automated continuous exchange system. It is designed to replace conventional cation exchange methods. The system continuously exchanges resin, and the exchange process is automated.

1. Fresh resin
2. Exhausted resin
3. Replacement with fresh resin
than the feedwater. As the resin volume in make-up water with higher CO2 content ionic conductivity, due to the addition of there are periodic fluctuations in the cati...
As the resin volume in the EDI module is significantly smaller, the CACE measurement after EDI module picks up the change about 6 minutes earlier than after conventional cation exchanger active carbon columns with optimized hydraulic designs.

In the case of a critical contamination event, this faster reaction time can be vital for a water steam cycle as those few minutes after the faster correction action thus minimize the consequences of such contamination.

Compared to larger cation exchangers in column designs introducing further lag times (e.g. with flex hose connections, dead space inside the column) the CACE measurement after EDI is expected to react 6 to 12 minutes earlier.

Compared to larger cation exchangers, the EDI technology introduces further lag times in controlling water steam cycle chemistry. The monitor AMI CACE is a key component in controlling water steam cycle chemistry. The AMI CACE continuously measures conductivity after passive cation exchanger (bottle type cation exchanger with optimized hydraulic designs).

As cation conductivity is one of the most frequent online parameters in a water steam cycle and with many cycles operating in parallel, this new development calls for a different approach for the refurbishment of conventional sampling systems: instead of replacing only individual sensors and transmitters or single analysers, the replacement of complex offline instrumentation sets can be justified by the increase in reliability and the reduction of system operational costs.

For such larger scope refurbishment projects, it is worth checking and improving the safety and reliability of sample conditioning equipment and to adapt it to the requirements of modern instrumentation.

酸度電導度計の測定における新しいTCA（Conductivity After Cation Exchange, CACE）技術を、新技術として提案する。CACE技術は、従来の電導度監視システムと比較して、サンプリングシステムの非線形性補正が不要であり、ゲル交換樹脂の交換が必要としない。これにより、システムの保守コストと環境負荷が大幅に軽減される。この新しいCACE技術は、水分質電導度の測定を可能にし、システムの信頼性を向上させ、システムの運転コストを削減することができる。