

Literature Survey of Ultrasonic Techniques for Pyroprocessing

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1. Introduction

Ultrasound has been ubiquitously utilized for various applications in numerous industrial fields. Sometimes, the ultrasound-based techniques are called ultrasonic sonoprocessing and their efficiencies and performances have been sufficiently proven for long years. This paper performs basic literature survey to preliminarily check applicability of the ultrasonic techniques for pyroprocessing.

2. Ultrasonic Techniques for Pyroprocessing

Since ultrasonic techniques have been already usually used for electrochemistry and metallurgy, it is evaluated that they can be also applied for pyroprocessing which has special environments; radioactive, corrosive and high temperature. As a practical example, C.D. McKinney reported the ultrasonic mixing/separation, dispersion, extraction, dissolution can be useful and effective for pyrometallurgy by experimental demonstrations [1]. Also, Y. Kumar G recently showed the ultrasonic liquid level measurement technique of hygroscopic, high temperature LiCl-KCl molten salt in an electrorefiner [2]. In addition, the relevant recent studies are summarized in Table 1 and it can be seen that the ultrasonic techniques have been developed for various nuclear applications.

Therefore, the many previous studies showed that the ultrasonic technologies can be also applied for the pyroprocessing and they can improve the processing performance and efficiency.

3. Conclusions

In this paper, we preliminarily surveys literatures on ultrasonic techniques for pyroprocessing. Since many previous studies report the ultrasonic techniques can provide useful and effective processing/sensing solutions for hazardous environments, it is carefully considered that they have promising applicability in the pyroprocessing. However, depending on application target in the pyroprocessing, the practical feasibility, effectiveness, and economics should be closely examined before development.

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Table 1. Recent studies on ultrasonic techniques in the nuclear field

No	Researcher	Year	Principle	Applications (Study Object)
1	Pacific Northwest National Lab. (US) [3-4]	2001	Impedance	Slurry density monitoring during radioactive waste retrieval and transport operations
2		2004	Attenuation	Slurry mixing monitoring in radioactive waste tank
3	Bhabha Atom. Research Center (India) [5]	2021	Time of Flight	Real time concentration estimation of Ammonium Nitrate produced from nuclear fuel cycle facilities
4	University of Leeds School of Chemical and Process Engineering (UK) [6]	2022	Attenuation	Concentration profiling of nuclear waste suspensions in pipe-flow
5	Veer Surendra Sai University of Technology (India) [7]	2015	Time of Flight	Ultrasonic velocity and concentration measurements for characteristics analysis of Tributyl Phosphate(TBP) used in aqueous reprocessing
6	Los Alamos National Lab. (US) [8]	2022	—	Continuous particle monitoring in molten salt piping systems

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