PLASMA REACTOR TO VIABILIZE THE VOLUMETRIC REDUCTION OF RADIOACTIVE WASTES

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Introduction

According of the International Atomic Energy Agency – IAEA, nuclear waste, also known as, radioactive waste, is any material containing a higher concentration of radionuclides than those considered safe by the national authorities. In Brazil, there is a National Nuclear Energy Commission to regulate. These wastes can be generated in nuclear power plants, industries, hospitals and research institutes.

To permanently dispose of these radioactive wastes of low and medium level of radioactivity safely and cost effectively, these should be transformed into the physical and chemical compounds suitable for radionuclides immobilization with maximum volume and exhaust gaseous reduction.

Incineration is used as a treatment for a very wide range of wastes. Incineration itself is commonly only one part of a complex waste treatment system that altogether, provides for the overall management of the broad range of wastes that arise in society. The objective of waste incineration, in common with most waste treatments, is to treat waste so as to reduce its volume and hazard, whilst capturing (and thus concentrating) or destroying potentially harmful substances.

The incineration of waste is one of the most widespread and effective technologies allowing considerably to reduce waste volume. In this scope, among the promising technologies for the radioactive waste treatment is the plasma technology that allows reducing substantially the waste volume after exposing them to temperatures above 2500°C. In the planning and management of radioactive waste, the challenges related to plasma technology are presented as a motivation factor for the possible implantation of plasma reactors in nuclear plants and research centers with the objective of improving the process of radioactive waste treatment. In this way, this work aims to evaluate the use of plasma technology for the incineration of radioactive waste for volumetric reduction and immobilization of this waste.

Methods

In this work, a plasma reactor was used for waste incineration, and all reactor parameters (electric energy ranges, maximum arc current, maximum working voltage, air flow, maximum energy conversion efficiency, average temperature of heated gas, heated enthalpy) was controlled based on literature. The experiment was carried out in the plasma reactor (laboratory scale) of LPP in the ITA, using plasma torch transferred arc and with gaseous argon oxidizing agent. The electrical and thermal characteristics of the auxiliary systems of the plasma reactor

were obtained using transducers and thermocouples. The composition of the gases in the process was analyzed using mass spectrometer and spectrophotometer.

Results

The accuracy of the data was important to ensure good results in the process, which allowed the extraction of relevant information from the experiments performed. The volumetric reduction reached 92% in relation to the sample before being processed, with a peak temperature of 1800°C. Although a larger amount of argon flow intensify the cooling of the inner wall of the reactor, and further promote the dilution of the plasma, the arc voltage increases, resulting in higher power operation.

Conclusions

In the present work a high efficiency thermal transfer torch was characterized , able to validate the use of the plasma jet for the treatment of radioactive waste.