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► **To cite this version:**

Georges Matta, Nicolas Courtois, Jean-Baptiste Champenois, Stephane Perrin, Nicolas Sbirrazzuoli. Thermal behaviour of Bituminized Waste Products. ESTAC13 - The 13th European Symposium on Thermal Analysis and Calorimetry, Sep 2022, Palerme, Italy. , 2022. cea-03882866

HAL Id: cea-03882866

<https://cea.hal.science/cea-03882866>

Submitted on 2 Dec 2022

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ESTAC13

The 13th European Symposium on Thermal Analysis and Calorimetry
19-22 September 2022, Palermo, Italy
www.estac13.org



Thermal behaviour of Bituminized Waste Products

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Keywords: bitumen, kinetic parameters, nuclear waste, thermal analysis

Owing to its high chemical inertness, impermeability, and confining ability, bitumen was chosen in France, since the 1960's for embedding co-precipitation sludge produced during the reprocessing of nuclear spent fuel, yielding Bituminized Waste Products (BWPs). In the scope of the nuclear safety process, the thermal behavior of these BWPs has to be investigated from their production until their long-term disposal. It is thus crucial to study the physicochemical and thermochemical phenomena involved when they are exposed to heat sources.

Thermogravimetric analysis coupled to differential thermal analysis was used to assess the kinetic parameters related to the reactions that might occur when these materials are exposed to non-isothermal heating conditions, under various atmospheres. Firstly, a simplified model system, the pure bitumen, was studied. The complexity of the model system was then increased, by considering the salts that are present in significant quantities in BWPs, in particular sodium nitrate.

Under nitrogen atmosphere, the pure bitumen exhibits convolved events, which are attributed to its pyrolysis [1]. Under air atmosphere, it undergoes three exothermal and one endothermal events that respectively result from oxidation and cracking reactions [2][3]. Under nitrogen, bitumen embedding sodium nitrate shows an exothermic peak due to the oxidation reaction of the bitumen with nitrates. The activation energy for each event has been determined using several kinetic methods based on non-isothermal heating conditions.

References

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