



**HAL**  
open science

## Thermal behaviour of Bituminized Waste Products

Georges Matta, Nicolas Courtois, Jean-Baptiste Champenois, Stephane Perrin, Nicolas Sbirrazzuoli

► **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

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# ESTAC13

*The 13th European Symposium on Thermal Analysis and Calorimetry*  
19-22 September 2022, Palermo, Italy  
[www.estac13.org](http://www.estac13.org)



## Thermal behaviour of Bituminized Waste Products

**Georges Matta<sup>1,2\*</sup>, Nicolas Courtois<sup>1</sup>, Jean-Baptiste Champenois<sup>1</sup>, Stéphane Perrin<sup>1</sup>, Nicolas Sbirrazzuoli<sup>2</sup>**

<sup>1</sup>CEA, DES, ISEC, DE2D, Univ Montpellier, Marcoule, France

<sup>2</sup>University of Côte d'Azur, Institute of Chemistry Nice, UMR CNRS 7272, 28 Avenue de Valrose, 06108 Nice Cedex 2, France

\*Corresponding author: e-mail: [georges.matta@cea.fr](mailto:georges.matta@cea.fr)

**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

- [1] M. Cardona, D. C. Boffito, and G. S. Patience, *Fuel*, 143 (2015) 253–261
- [2] S. Zhao, W. Pu, M. A. Varfolomeev, Y. Liu, and Z. Liu, *J. Pet. Sci. Eng.*, 192 (2020) 107331
- [3] C. Yuan, D. A. Emelianov, and M. A. Varfolomeev, *Energy and Fuels*, 32 (2018) 5571–5580