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Fibers innovative burning and reuse by Self-propagating High temperature Synthesis (SHS)

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The treatment of asbestos containing waste deriving from civil building and industrial applications is a social alert and an environmental problem. The project LIFE12 ENV/IT 000295 FIBERS "Fibers innovative burning and reuse by Self-propagating High temperature Synthesis (SHS)" has developed an innovative technique alternative to conventional high T processes. The University of Genoa has developed an apparatus and a technique for triggering the breakdown reaction of chrysotile by means of an alumino-thermic reaction in a process of combustion synthesis well known as Self-propagating High temperature Synthesis or SHS. This approach yielded interesting results and allowed the development of an efficient method for inerting natural asbestos fibers and man–made products carrying fibers at the scale of some grams [1]. The experiments were based on the couples $Fe2O_3$/Mg by implementation of two prototype plants. The varying parameters were: 1) different Asbestos-Containing Waste (ACW) massive (Eternit, linoleum) and friable asbestos; 2) ACW abundance; 3) size of the pellet 4) under two triggering systems (induction by a W coil and oxyacetylene torch). The reactions were carried in two configurations: a) discontinuous, allowed us to obtain data for the development and fine-tuning of the reaction, b) continuous, was indispensable for the development and fine-tuning of the process parameters towards industrial scale up. After the combustive reaction all samples were characterized by SEM-EDS and XRPD analysis. All experiments demonstrated effective in destructing the fibrous habit of chrysotile, turning its composition to stubby olivine grains. We optimized the parameters to achieve complete conversion of the asbestos to mineral grains in all the cases. The efficiency of the SHS reaction in the discontinuous and continuous configurations was highlighted by the characterization of the post-combustion material under SEM-EDS and XRPD that verified the absence of fibers within the limits established by the regulations. The SHS process in comparison with conventional thermal treatments, due to fast reaction time, low activation energy, particularly advantages the asbestos inertization and positively reflects into time and costs of the process. Finally, the product of this transformation is liable to be re-used, e.g. as abrasive, or refractory material; this represents the end of waste status and a second life as secondary raw material. This work was carried out in the frame of LIFE12 ENV/IT/000295 FIBERS co-funded by the European Commission.

[1] Gaggero L., Ferretti M., Belfortini C., Isola E. (2010) GE2010A000032