ANALITICAL EVALUATION OF WASTES CONTAINING ASBESTOS AFTER INERTIZATION TREATMENT BY PYROLITIC PROCESS

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Wastes recovery efficiency have been slightly improved by Decree n.248 of 29/7/2004 on" Rules on determination and disciplines of recovery activities of products and goods of asbestos and containing asbestos" by defining processes and treatment able to bring to a complete transformation of crystallochemical features of asbestos.

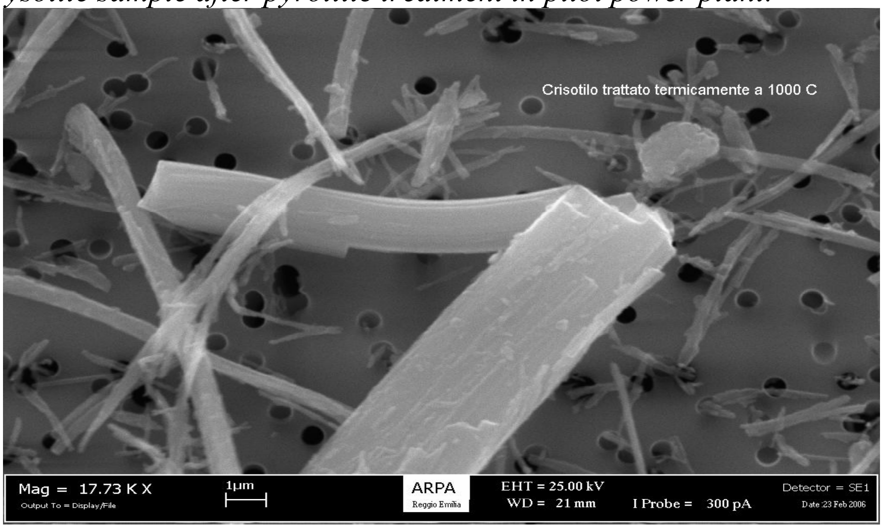
Such treatments if properly applied allows to avoid the disposal of wastes in dumps. They also allow the reutilization of processed wastes. No adequate power plants suitable for the mentioned treatment presently exist in Italy.

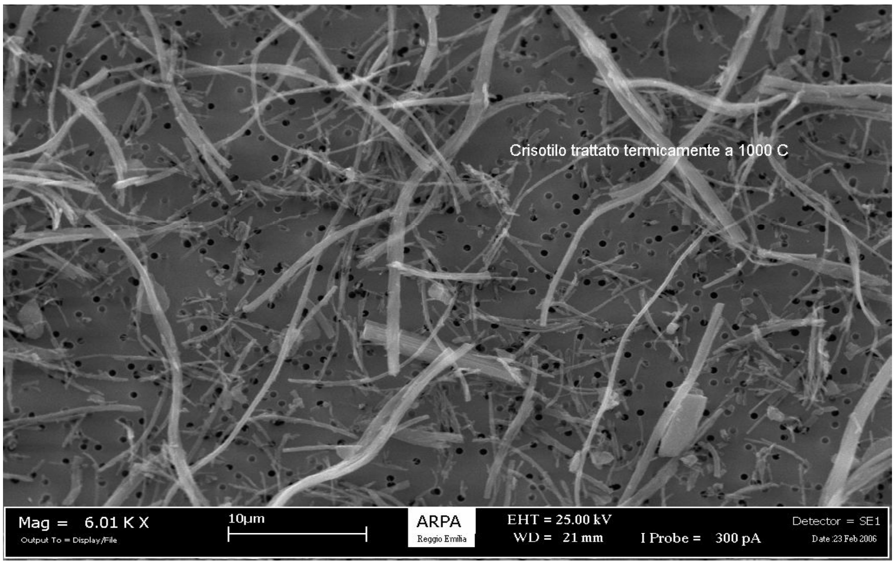
Intense research activity is devoted to the start up of pyrolitic processes applied to wastes deriving from concrete/asbestos to be reutilized in environmental recovery. Decree n.248 reports characteristics of processed material which must be asbestos free and accompanied by mineralogical composition of final product.

Present paper propose an analytical protocol suitable for law need and able to guarantee safety conditions of wastes after crystallochemical transformation.

In order to verify such transformations analytical procedures adopted in qualified laboratories on asbestos analysis have been utilized. Pure chrysotile and concrete/asbestos samples have been analyzed by MOCF, DRX, SEM and FTIR after 2 hours heating at 600-700-800-900-1000 °C in muffle furnace. Some samples processed by pilot power plant by Aspireco have also been analyzed.

Figures 1-2. Chrysotile sample after pyrolitic treatment in pilot power plant.





Main high temperature transformations of asbestos containing materials are described as solid state deoxydrilization and recrystallizations (Gualtieri and Tartaglia, 2000). Thermal treatment of pure chrysotile evidences that after deoxydrilization at 800 °C starts a solid state transformation which brings to a complete recrystallization into silicatic-magnesiac phases (forsterite and enstatite). After this transformation chrysotile loses fiber-asbestos characteristic and is not dangerous for health. Asbestos by pure tremolithic amphibole thermally processed at 1100 °C after deoxydrilization is completely tranformed in diopside, enstatite and cristobalite. Flaked asbestos represented by chrysotile and processed at 1000 °C show that asbestos original characteristic is completely decomposed and three new phases of gehlenite, diopside and iron forsterite are cristallized. X ray diffractometry of concrete/asbestos constituted by prevailing chrysotile processed at 1100 °C evidence new phases deriving from chrysotile transformation such as prevailing gehlenite and diopside in a less extent. Quartz and hematite have also been found as residuals. SEM analysis of obtained materials evidence the inertization of fibrous phases which are transformed into irregular aggregates of neoformation crystals accompanied by loss of original dangerous character.

MOLP

Is the simplest technique which enables to verify optical properties of asbestos crystals.

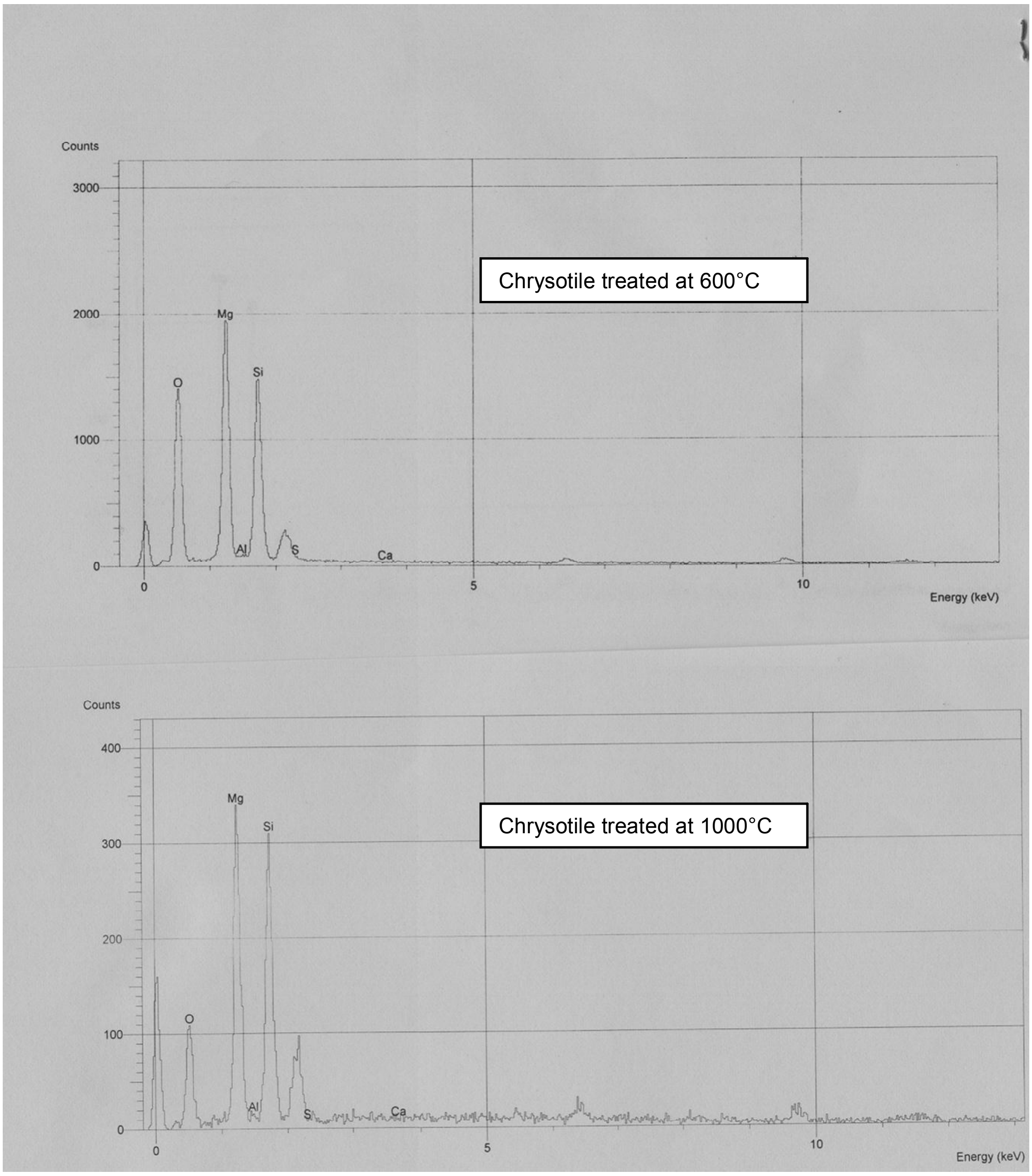
Chrysotile processed at relatively low temperatures (600-700 °C) is still characterized by original colour and colour changes which completely disappear at higher temperatures evidencing the complete crystalline structure tranformation.

DRX

Main (12.1°) and secondary (24.3°) reflexed rays expressed as 2 Theta are recognizable on chrysotile and concrete/asbestos samples processed at 600-700 °C while are not visible on samples processed at temperatures higher than 800 °C. A detailed study on diffractogram allows to recognize new recrystallization phases.

SEM

Chrysotile fibers morphology tends to modify loosing characteristic flexuous curves of chrisotile and assuming a rigid character closer to artificial mineral fibers. New recrystallized fibers tend to broke transverally differently to asbestos ones. Qualitative analysis of EDX spectra evidences an increasing oxygen loss related to increasing temperature of the sample.



FTIR

FT-IR spectrophotometry is a highly sensitive analytical method which allows to analyze samples in relatively short times and good repetivity. Samples of KBr, chrysotile and concrete/asbestos have been grinded , tranformed into tablets and analyzed. A decreasing of characteristic peak in chrysotile speactra related to increasing processing temperature was detected. The peak completely disappeared on samples processed at temperatures higher than 800 °C evidencing the complete transformation of chrysotile.

In conclusion the contemporary study of the same samples with all listed methods allows sure diagnosis on processed wastes.

References

Gualtieri A.F., Tartaglia A. (2000) Thermal decomposition of asbestos and recycling in traditional ceramics. Journal of the European Ceramic Society. 20 (9), 1409-1418.