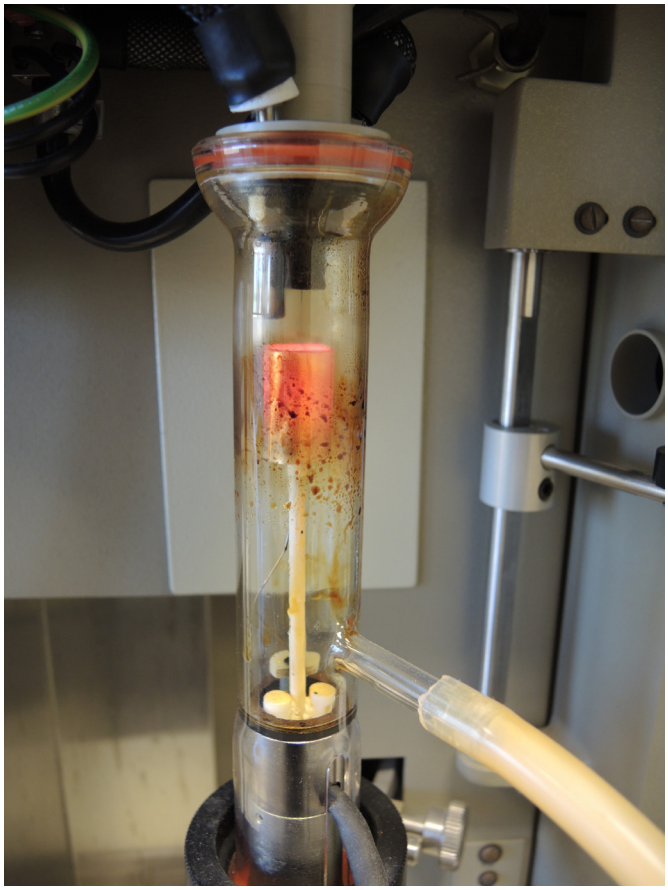
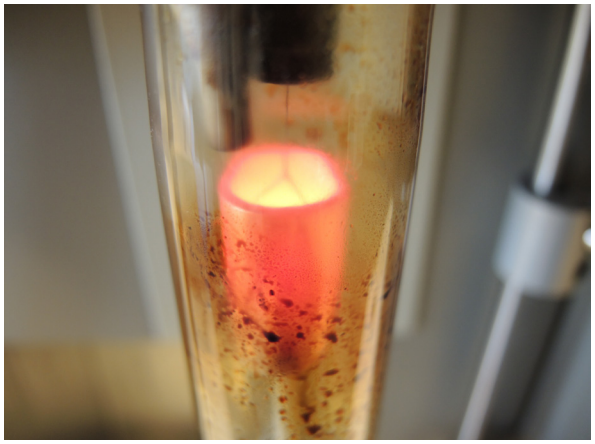
A quick and accurate study of the material composition using thermogravimetry

Franco Bulian



With these brief notes we would like to briefly introduce an interesting analytical technique present into the Catas chemical laboratory, the thermogravimetry or, simply, the TGA. Despite its apparently complex name, the TGA is actually a very simple technique that is really worth knowing because, in our opinion, it can easily help solve various problems or needs of a company.

As evident from the images shown here, the TGA consists in a combination of a balance with an oven. The oven is actually a real furnace able to reach very high temperatures up to 1000 ° C.
This combination (balance + oven) basically allows the instrument to measure the weight variations of a sample as the temperature increases.
What is typically observed during a thermogravimetric analysis is a step curve where each step represents a weight loss due to the evaporation of one of the components of the analyzed sample. In the end, when 500 ° C is exceeded, only the mineral components remain in the crucible which, obviously, cannot evaporate.
In reality, some mineral compounds undergo decompositions at very high temperatures and can therefore be distinguished and quantified. Calcium carbonate, for example, decomposes to calcium oxide at 650 ° C, releasing carbon dioxide. It is therefore sufficient to evaluate the loss of CO_2 to calculate the amount of carbonate originally present in the sample.



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Are the hotmelts EVA-based adhesives all the same?
No, besides being able to differ for the amount of minerals present, one of the important characteristics of these adhesives is the quantity of vinyl acetate that has been used for the production of the resin.
In fact, the two monomers used for the production of EVA resins are ethylene and vinyl acetate. Their ratio influences some important properties of the adhesive, such as wettability, solubility, heat resistance, etc. With thermogravimetry, weight loss due to the decomposition of the acetate group (acetic acid is released), is easily distinguished. It is consequently possible to easily perform comparisons between lots or among different products which may also have shown some problems in use.

Are the mineral-based composites all the same?
Also in this case the answer is negative and the proof is obtained from a very simple TGA analysis that clearly shows how much resin is present in quartz-based composites or in those called solid surface materials.
Quantification can help again to understand differences in performance, price, etc. between lots or similar products, sometimes proposed by different suppliers.

Do plasticisers present in plastics or gaskets long remain inside them?
thermogravimetry can immediately answer this question quantifying the plasticizers present originally in the material and after its aging (real or artificial).
The loss of plasticizers is often a serious problem as it determines the stiffening and the consequent possible origin of defects (cracking) on the finished products.

What can thermogravimetry therefore serve?
Thermogravimetry is a quick method for quantifying components of a certain material. The “quality control” of plastics, composite materials, paints and adhesives is certainly its ideal application area.
Comparisons among lots or different products are very quick and precise. Also thermal stability studies are possible with this method considering that the weight of a sample can be studied during scans at constant temperature and for long periods.
In this regard, it is also interesting to perform thermogravimetric analyzes both in an inert atmosphere (nitrogen) and in an oxidant environment (air). In the top box we present some of the cases that the Catas can solve using this analytical technique.

Finally, we would like to remember that Catas technicians are always available for information and meetings also aimed at the definition of small researches that can possibly highlight new and particular applications of this interesting technique.

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