



THE MYSTERIOUS TRAPEZIUM

IES PEDRO DE LUNA



Our investigation team receives an assignment to analyze a mysterious metallic piece related with a suspicious accident..



We make a previous analysis in our centre and complement it at EINA's laboratories and at the physics laboratories of The Science Department of Zaragoza University.

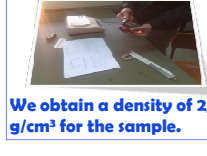
PRELIMINARY ANALYSIS



It is hard and displays metallic luster.



Heat and electricity conductor.



We obtain a density of 2,703 g/cm³ for the sample.

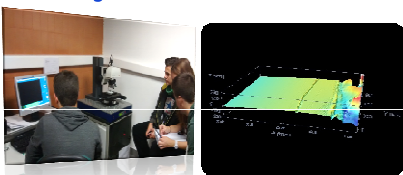
Conclusions:

- It has metallic properties.
- Density similar to aluminium.
- Is it an aluminium alloy?

To determine the nature of the material, the investigation team has moved to the confocal and electronic microscopy laboratory at EINA.

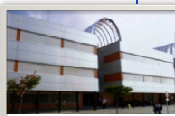
LASER CONFOCAL MICROSCOPY

- Non destructive technique which allows to reconstruct the three-dimensional image of the surface of the sample.
- The height of the surface flaws can be measured.



Topography of the surface of the sample:

- Fractures are observed on the edges.
- Very smooth central surface but with small micron-sized roughness.
- Conclusion: the material has been polished, with what intention?



ELECTRONIC MICROSCOPY

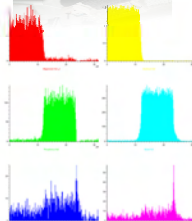
- The scanning electron microscope is used for the analysis of the sample.
- Two analyses were performed : one on the surface and the other on the cross section.



Surface results:
-Mainly made up of Ni, with a small amount of Cr and Co.

Cross section results:

- It shows a profile of layers made up of different materials.
- Upper layer is very thin and made up of Ni, Cr and Co.
- Inner layer is made up of Al with some Mg.



Conclusion:

- The piece is Al with some Mg, covered by a thin and polished layer of Ni, Co and Cr.



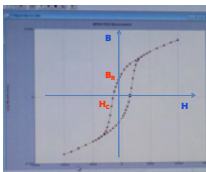
Some of the sample materials, Co and Ni, present magnetic properties. The team moves to the Physics laboratories to determine the sample's magnetic properties.

HYSTERESIS LOOP OF THE SAMPLE

- It is ferromagnetic.
- Residual magnetism , B_R , and coercive field, H_c , low.

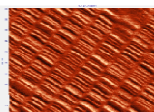
Conclusion:

- It is a soft magnetic material.
- You can reverse its polarity easily.



ATOMIC AND MAGNETIC FORCE MICROSCOPY

- We get the topographic image of the material and the magnetic domains that it contains.



- We can observe alternate magnetic domains, which could mean it is a binary system of information storage.

Conclusion:

We are facing magnetic domains, bits.

FINAL CONCLUSIONS

Researching the usual composition of these mechanisms, we found out that they usually use an alloy substrate of Al-Mg, covered by a layer of Ni-P to provide hardness and polish, and an upper layer of Co, which gives the piece its magnetic properties.

Our hypothesis is that we have a piece of a storage hard disk.

