Study of metal recovery from printed circuit boards by physical-mechanical treatment processes

C. Mori De Oliviera[1], R. Bellopede[1], A. Tori[2], P. Marini[1]

[1]Politecnico di Torino – DIATI, Italy
[2]OSAI Automation System S.p.A, Italy

E-mail: rossana.bellopede@polito.it

The acceleration of the global production and consumption of electronics device and the concerns related to waste electrical and electronic equipment (WEEE) motivated this research. Printed circuit board (PCB) can be found in almost all type of electronic devices, making it an important component of WEEE. It has a heterogenous composition made of polymers, ceramic material, and metals. It contains heavy metals that can cause environmental impacts due to improper disposal. But on the other hand, there are elements with added value, such as copper, gold, silver, iron, aluminum and critical raw materials, such tantalum that can be recovered, making PCB scrap an economically attractive for recycling. The metal recovery can conserve natural resources, since it prevents new minerals from being extracted and it is a great contribution to the circular economy, removing the waste from its disposal and reinserts in the production cycle. The mechanical recycling of PCBs was studied through different operations, with the following sequence, comminution, granulometric classification, magnetic separation, gravity separation and electrostatic separation. The goal is to concentrate metals, especially copper, identifying the main elements obtained through cheaper processes to recycle e-waste. The PCB composition was initially carried out through the scanning electron microscope analysis. Then, it was shredded in a cutting mill and classified according to their grain size by sieving. Afterwards, a magnetic separation has been performed together with gravity and electrostatic separation of the non-magnetic fraction. The products obtained were observed with the macroscope to qualitatively assess the metallic content. The results obtained allowed to conclude that physical-mechanical techniques have high potential to produce a concentrate product with high added value. The application of magnetic separation proved to be efficient, as it enabled the recovery of high percentage of iron. In gravity separation, the metal recovery was satisfactory for the particle size -0.6 + 0.3 mm and for the particle size -1.18 + 0.6mm. In the recovery of metals by electrostatic separation the efficiencies obtained was really high the lower particle size (-0.3mm).