

# Metal Recovery via Automated Sortation

Research Team: Hao Yu, Diran Apelian

Waste recovery and recycling are becoming increasingly more pivotal to a sustainable future for both the ferrous and non-ferrous metal industries. Often, the “waste” generated in the process still contains material of potential value. As new technologies are developed, it is becoming possible to further process and recover the material of value. Resource recovery serves the dual purpose of reducing the volume of the waste to be discharged and generating an economic spin-off.

Let us consider recycling of aluminum as an example. Aluminum has provided a strong impetus for the recycling industry because the recycling of aluminum only uses 5% energy compared to the energy used from aluminum extraction; meanwhile, the emission of greenhouse gases is also significantly reduced. However, when it comes to high value metals, metal recovery and recycling is not practiced widely; the reasons are complex, but include low volumes, industry fragmentation, as well as lack of specific technologies for these markets. High strength metals and high value precious metals, such as Ni, Co, Mo and Ta are valuable resources to us, and need to be recovered and recycled.

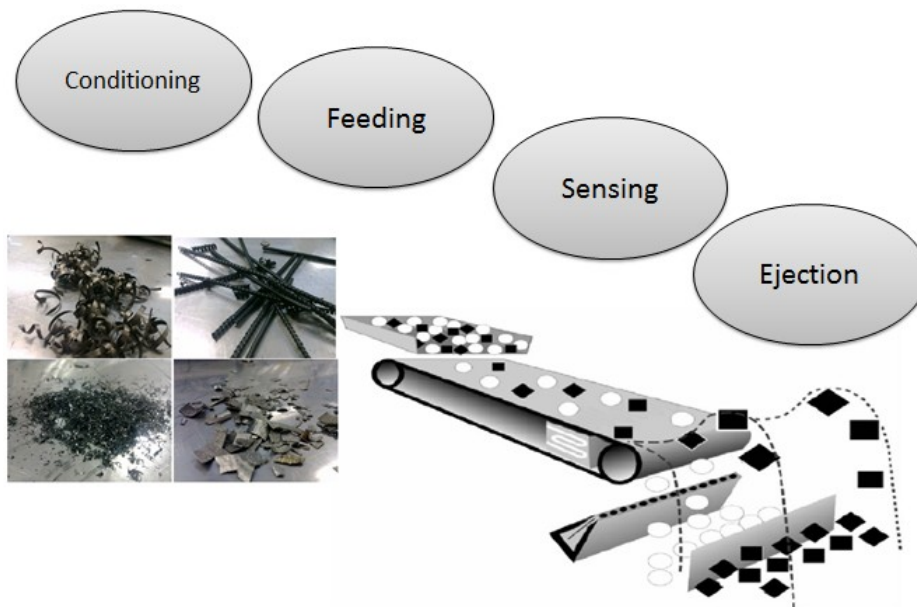


Figure 1: Four Steps of Automated Sortation- Conditioning, Feeding, Separation and Ejection.

An automatic sortation system consists of four parts: (i) Conditioning of the Feed, (ii) Feeding onto the sensing platform, (iii) Separation, and finally (iv) Ejection into

identified bins. In this project, we focused on the feeding and ejection of valuable metals such as Ta, and particularly chips of Ta that are in the size range of 5mm and below ( $3/16^{\text{th}}$  of an inch). In order for waste streams to be accurately scanned by the optoelectronic sensor and successfully separated by the ejection device, it is crucial to transport the mixed samples onto the work station individually. This requires that each sample does not contact any other samples, and that the chips are distributed uniformly on the scanning bed. Because the mixed materials are entangled and twisted, it was challenging to provide a monolayer of feeding materials. Moreover, since the majority of current ejection devices are designed to separate samples the size of an "industrial fist" (which is about 5 inches in diameter), it was necessary to produce a micro ejection system, which was capable of removing unwanted contaminated particles in the size range of interest.

In order to achieve these objectives, the following methodologies were pursued.

- I. Create taxonomy of the best-fit methods for handling and sorting of different material types and particle sizes during the recycling process.*
- II. Develop a micro ejection technology for the removal of the unwanted materials from a particulate waste stream.*
- III. Create a feed mechanism to produce a monolayer of cleaned, crushed, and dried machining chips with a nominal size range of 5 – 8mm and comprised of material similar to the samples provided by the focus group members.*