Scrap metal consolidation

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Keyword 1: sustainability *Keyword 2: roll bonding* *Keyword 3: delamination*

Abstract

Manufacturing accounts for a significant portion of the global CO2 emissions, creating an increasing demand for processes that encompass the entire manufacturing lifecycle to reduce environmental impact. To this end, metal scrap recycling is a widely promoted and established practice to replace to primary metal production. In order to further decrease the environmental and energy penalties for recycling processes, solid-state re-purposing alternatives such as re-use or re-manufacturing are commonly considered, finding applications in discrete production and in steel construction, respectively. However, mainstream applications are still rare for both, since re-manufacturing activities are limited to mature products at the end of their technological life cycle; and re-use of existing metal stock instead of virgin metal imposes dimensional restrictions and logistical risks. Currently scrap re-forming is the most underutilized re-purposing path, since each new re-forming operation leads to thinner gauge lengths, or to shrinking contour (i.e. downcycling). We propose that, by the introduction of a scrap metal upcycling approach, the dimensional restrictions of conventional re-use strategies can be lifted, prolonging the metal life cycles and enabling the extraction of the stored processing value for further re-use. To this end, we further propose that the roll-bonding process could be adopted to scrap sheet metal consolidation, enabling: (i) new forms of semi-finished product manufacturing routes, decreasing overall scrap metal output due to industrial operations; (ii) facilitated application of roll-bonding process to a larger extent. This approach, if utilized globally only for fabrication scrap, would tap the potential of re-purposing 254 million tons of steel scrap to the manufacturing ecosystem per year, entirely avoiding energy- and CO2-intensive scrap re-melting processing paths.

References

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