H2020 METGROW+ project develops technologies for extracting valuable metals from metallurgical waste and low-grade ores, from which recovery is not yet economically viable. The research involves the development and combination of pyro-, hydro-, solvo-, electro-, ionic- and biohydrometallurgical unit operations as well as final residue matrix valorisation. As a result, a Metallurgical Systems Toolbox is created for the benefit of the European industry and society.