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ENVIRONMENTAL ASSESSMENT OF THREE WELDING TECHNOLOGIES FOR EPD PREPARATION IN INDUSTRIAL PRODUCTION

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Abstract

Modern enterprises are increasingly focusing on the environmental aspects of production. Widespread MIG and TIG welding technologies are giving way to innovative laser-arc hybrid welding, requiring comprehensive analysis for EPD certification. The theses propose the LCA method according to the EN 15804 standard to select the most environmentally friendly and cost-effective technology. MIG (fast, cheap, with high CO₂ emissions), TIG (accurate, but slow and energy-intensive) and laser-arc hybrid (deep-melting with minimal GWP and cost) are compared. The methodology allows ChelPipe to promptly prepare the EPD in SimaPro. The study confirms the optimality of laser arc welding and the applicability of the approach immediately after installation of the equipment.

Keywords

LCA, welding technologies, EPD, environmental impact, SimaPro, ChTPZ.

ЭКОЛОГИЧЕСКАЯ ОЦЕНКА ТРЕХ СВАРОЧНЫХ ТЕХНОЛОГИЙ ДЛЯ ПОЛУЧЕНИЯ ЭПД В ПРОМЫШЛЕННОМ ПРОИЗВОДСТВЕ

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Аннотация

Современные предприятия уделяют все больше внимания экологическим аспектам производства. Широко распространенные технологии сварки MIG и TIG уступают место инновационной лазерно-дуговой гибридной сварке, требующей всестороннего анализа для сертификации EPD. В диссертации предлагается метод LCA в соответствии со стандартом EN 15804 для выбора наиболее экологически чистой и экономичной технологии. Сравниваются MIG (быстрый, дешевый, с высоким уровнем выбросов CO₂), TIG (точный, но медленный и энергоемкий) и лазерно-дуговой гибридной (глубокая плавка с минимальным ППП и стоимостью). Данная методика позволяет ЧТПЗ оперативно подготовить EPD в SimaPro. Исследование подтверждает оптимальность лазерной дуговой сварки и применимость подхода сразу после установки оборудования.

Ключевые слова

LCA, сварочные технологии, EPD, воздействие на окружающую среду, SimaPro, ЧТПЗ.

Modern enterprises face the need to minimize the environmental footprint of production. Well-known solutions such as MIG welding (fast and cheap, but with high CO₂

emissions) and TIG welding (high-precision, but energy-intensive and slow) have significant disadvantages in terms of GWP and cost. The proposed approach, a comparative LCA analysis of the three technologies according to EN 15804 in SimaPro, addresses these gaps by providing quantification and rapid EPD preparation [1, 2].

The LCA is performed using three methods: MIG shows average GWP values and low cost; TIG shows the worst in terms of energy intensity and speed; and laser-arc hybrid (a combination of laser and arc for deep penetration) demonstrates minimal GWP and total costs. SimaPro simulations confirm the results: laser-arc technology is optimal. The methodology is applicable for MANPADS immediately after equipment configuration, speeding up certification [3].

As a result, laser arc welding is recognized as the most environmentally friendly and economical. The findings justify the transition to innovative technologies. Further development is the integration of LCA with real production data and expansion to other materials.

Literature

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