Analisis kuat lekat, kekerasan, dan struktur mikro lapisan stellite pada permukaan baja 410 dengan proses flame spray, plasma spray, dan high velocity oxyfuel spray = Bond strength, hardness, and microstructure analysis of stellite coating applied on 410 steel surface using flame spray, plasma spray, and high velocity oxyfuel spray process / Nail Widya Satya

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Abstrak

ABSTRAK
Thermal spray sering diaplikasikan pada leading edge bilah turbin uap untuk meningkatkan ketahanan abrasi. Stellite adalah salah satu material yang sering digunakan dikarenakan ketahanannya yang baik terhadap aus. Penelitian ini bertujuan untuk mengkomparasi properti metode flame spray, plasma spray, dan HVOF dalam mendeposisikan lapisan Stellite ke bilah turbin baja tahan karat martensitik 410. Hasil lapisan plasma spray dan HVOF menunjukkan deposisi lapisan yang rata sedangkan flame spray tidak. Ketiga proses thermal spray memenuhi spesifikasi kuat lekat minimum manufaktur. Rata-rata kuat lekat dan kekerasan tertinggi didapat dari proses HVOF dengan nilai masing-masing 33,1 MPa dan 719 HV. Berdasarkan standar deviasi kuat lekat dan kekerasan, proses HVOF memiliki hasil lapisan paling homogen. Kekerasan substrat di bawah antarmuka pasca proses pelapisan flame spray, plasma spray, dan HVOF masing-masing naik sebesar 236%, 56%, dan 65% dari spesifikasi substrat. Lapisan HVOF memiliki tampilan penampang yang paling baik. Persentase porositas, diameter porositas, dan rata-rata panjang unbonding terkecil didapat pada proses HVOF dengan nilai masing-masing 0,2%, 7,2 Î¼m, dan 31%. Struktur mikro lapisan pasca pengetsaan menghasilkan fasa-fasa yang berhubungan dengan masukan panas. Struktur dendritik terbentuk pada lapisan proses flame spray dan plasma spray pasca pengetsaan, namun tidak pada proses HVOF. Oksida dan karbida kobalt maupun krom mungkin terbentuk pada lapisan.
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ABSTRACT
<hr /> Thermal spray is often applied on steam turbine blade leading edge to increase abrasion resistance. Stellite is one of the commonly used material as it is known to wear protection against abrasion, oxidation, and corrosion at elevated temperature. Thermal spray method generally used in industry are flame spray, plasma spray, and HVOF. This research is intended to compare properties of those methods in depositing Stellite coating on 410 martensitic stainless steel turbine blade. Plasma spray and HVOF coating show even deposition while flame spray coating not. Those three coatings meet manufacture minimum bond strength requirement. On the flame spray process, higher preheat temperature resulted in higher bond strength. Preheat temperature variation relatively not affect coating hardness. Highest average bond strength and hardness are got by HVOF process with a value of 4.799 psi (33,1 MPa) and 719 HV respectively. According to bond strength and hardness standard deviation, the HVOF process gives the most homogeneous coating. Substrate

hardness just below the coating interface after flame spray, plasma spray, and HVOF process are raised by 236%, 56%, and 65% each from the specification. HVOF coating has the best cross section compared to others with little splat and porosity. Flame spray coating has the most significant and highest amount of porosity. In terms of percentage and size, HVOF gives the best result with a value of 0,2% and 7,2 Î¼m respectively. The smallest coating interface unbonding is got by the HVOF process, with an average of 31%. Flame spray, plasma spray, and HVOF coating microstructure after etching show phases related to heat input during application. The dendritic structure is observed on flame spray and plasma spray coating after etching but not on HVOF process. Oxides like Cr₂O₃, CoCr₂O₄, CoO, and carbides like CoC, Cr₇C₃, Co₆W₆C, or Cr₂₃C₆ probably formed in the coating based on EDS result. Moreover, chemical composition result also indicates the formation of silicon oxide on coating and iron oxide at the coating interface. </p>