# เทคโนโลยีการพอกผิวด้วยเลเซอร์เพื่อซ่อมบำรุงรางรถไฟ

Laser Cladding Technologies for Rail Maintenance

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Rails suffer from various kinds of damage, most notably wear and rolling contact fatigue. The two mechanisms can cause damage ranging from a uniform wear rate, plastic flow, hairline cracking, sub-surface cracking and spalling, and in some serious cases, a through-cracking of the rail. The damaged rails can remain in service, whereby the speed of the train going over the damaged section is significantly reduced to prevent derailment. This will cause disruption in the railway schedule. A successful and widely accepted treatment is to routinely reprofile rails by on-site grinding and also to remove short cracks before they propagate into the rail. Grinding results in a large thickness loss on the rail and can only be done a certain number of times before the rail section will need to be replaced. The rail replacement is a major task, both in term of time and budget. Shielded Metal Arc Welding (SMAW) and Flux-Cored Arc Welding (FCAW) are technologies used for rail repair. This research involves a study of laser cladding technology that can be used for rail localized maintenance. By using a cladding-type method specifically only on wear scars, the repaired rail can maintain its original dimension. It is also expected that the repair can be done repeatedly on the same location. With less material removal and the ability to maintain the original dimension, the lifetime of the rail will improve. This study covers the use of Fe-based alloy and Co-based alloy as cladding materials. The properties of coatings produced via laser cladding were compared with the weld repairs using SMAW and FCAW. Their fabrication techniques, laser

polishing and basic performance were also studied. Wear testing using a pin-on-disc configuration revealed that the wear resistance of the laser-cladded Cr steel is 9 times greater than that of the SMAW low alloy steel weld repair. However, a production cost per day of the laser cladding was 11 times higher than that of SMAW. There is also a variation in cost due to the choice of the laser source, for example a diode laser is cheaper than the fiber laser. It was also found that laser polishing has a potential to replace surface grinding of rail. Laser polishing on tools steel laser cladding can reduce the surface roughness to 1 μm Ra which is comparable to the surface roughness of a rail head after grinding. A guideline based on economic viability is also given and will be used as a basis to focus our effort on the next phase of this research.