

## INTISARI

Fenomena *Urban Heat Island (UHI)* menyebabkan suhu di wilayah perkotaan meningkat akibat penggunaan material perkerasan berwarna gelap yang menyerap panas. Salah satu upaya mitigasi *UHI* adalah penggunaan *Heat Reflective Coating (HRC)* pada permukaan jalan yang mampu meningkatkan performa termal. Namun, penerapan *HRC* dapat mengurangi kekesatan permukaan, yang berisiko terhadap keselamatan lalu lintas. Penelitian ini bertujuan mengevaluasi pengaruh penambahan *skid resistance agent* berupa pasir silika dan keramik terhadap performa termal, kekesatan, dan ketahanan abrasi dari lapisan *HRC*.

Pengujian dilakukan pada tiga jenis bahan dasar utama yaitu epoksi, akrilik, dan becool dengan dan tanpa penambahan *skid resistance agent*. Pengujian performa termal menggunakan *Heating Box*, pengujian abrasi dengan metode kering menggunakan *rubber wheel (dry track abrasion test)*, dan *British Pendulum Test* untuk membandingkan performa dari beberapa parameter terkait perkerasan reflektif dengan perkerasan konvensional. Penambahan silika dan keramik meningkatkan kekesatan dan performa termal. Benda uji akrilik dengan silika dan keramik mencatat BPN tertinggi sebesar 77,6 dan 78, melebihi kontrol 72,9. Performa termal terbaik sebelum abrasi ditunjukkan oleh epoksi-silika dan epoksi-keramik dengan suhu 59,64°C dan 56,70°C, dibanding kontrol 81,90°C. Setelah abrasi, keramik menunjukkan mass loss lebih rendah dibanding silika pada akrilik dan becool, berbanding terbalik dengan epoksi. Keramik memiliki daya lekat tinggi karena teksturnya, sementara silika yang halus dan bulat lebih mudah terlepas dari permukaan *HRC*. Silika pada epoksi dan akrilik mengalami penurunan signifikan pada BPN dan performa termal ( $\Delta T > 9^\circ\text{C}$ ), akibat mass loss tinggi. Sebaliknya, penambahan keramik mempertahankan kekesatan dan performa termal yang lebih stabil dengan  $\Delta\text{BPN}$  dan mass loss rendah.

Formulasi *HRC* terbaik dihasilkan dari kombinasi akrilik keramik dengan nilai performa termal yang stabil ( $\Delta T$  sebesar 1,05°C) dengan suhu akhir terendah 62,19°C dan nilai *BPN* akhir 64,3. *HRC* dengan bahan dasar akrilik keramik berkontribusi terhadap kekesatan dan ketahanan lapisan permukaan pasca abrasi tanpa mengorbankan performa termal sehingga layak diterapkan di lingkungan perkotaan.

**Kata kunci:** HRC, Performa Termal, Skid Resistance, Silika, Keramik

The Urban Heat Island (UHI) phenomenon causes increased temperatures in urban areas due to the use of dark-colored pavement materials that absorb heat. One mitigation effort for UHI is the application of Heat Reflective Coating (HRC) on road surfaces, which enhances thermal performance. However, the use of HRC may reduce surface skid resistance, posing a risk to traffic safety. This study aims to evaluate the effect of adding skid resistance agents, namely silica sand and ceramic, on the thermal performance, skid resistance, and abrasion resistance of HRC layers.

Tests were conducted on three main base materials: epoxy, acrylic, and becool, both with and without the addition of skid resistance agents. Thermal performance testing was carried out using a Heating Box, abrasion testing used the dry track abrasion method with a rubber wheel, and the British Pendulum Test was employed to compare performance parameters between reflective and conventional pavements. The addition of silica and ceramic improved both skid resistance and thermal performance. Acrylic specimens with silica and ceramic recorded the highest BPN values of 77.6 and 78, exceeding the control value of 72.9. The best pre-abrasion thermal performance was achieved by epoxy-silica and epoxy-ceramic specimens, with surface temperatures of 59.64°C and 56.70°C, respectively, compared to the control's 81.90°C. After abrasion, ceramic showed lower mass loss than silica in acrylic and becool-based HRC, the opposite trend observed in epoxy-based HRC. Ceramic particles exhibited stronger adhesion due to their rough texture, while the smoother, rounded silica particles tended to embed and detach more easily from the HRC layer. Silica in both epoxy and acrylic experienced significant reductions in BPN and thermal performance ( $\Delta T > 9^\circ\text{C}$ ) due to high mass loss. In contrast, ceramic maintained better post-abrasion skid resistance and stable thermal performance with low  $\Delta\text{BPN}$  and mass loss.

The best-performing HRC formulation was acrylic-ceramic, which demonstrated stable thermal performance ( $\Delta T$  of 1.05°C), the lowest final surface temperature of 62.19°C, and a final BPN of 64.3. HRC with an acrylic-ceramic base contributed to post-abrasion surface durability and skid resistance without compromising thermal performance, making it suitable for urban application.

**Keywords:** HRC, Thermal Performance, Skid Resistance, Silica, Ceramic