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Comparative Review and Analysis of Coal's Spontaneous Combustion Testing

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Spontaneous combustion in underground coal mining remains a persistent hazard for operations and mine personnel into the 21st century. In Australia, small-scale laboratory tests are used to quantify the risk of spontaneous combustion within mining operations allowing mine operators to undertake adequate controls towards prevention of spontaneous combustion.

In Australia, the three most common tests used are: the adiabatic oxidation method (R_{70}), Crossing Point (CPT) and Minimum Self-Heating Temperature (SHT_{min}). In addition, the intrinsic spontaneous combustion propensity classification (ISCP) is used for establishing a risk rating based on the R_{70} laboratory results. This risk ranking provides a guideline to spontaneous combustion severity on a scale from low to extremely high. However, the supporting literature for the currently adopted ISCP is minimal and no literature exists for the correlation between laboratory spontaneous combustion tests nor the creation of a risk matrix for CPT.

This paper presents the results of a correlation study between CPT and R_{70} based on a large historical database (n=285) showing that both CPT and R_{70} can be used to rank spontaneous combustion risk. It was found that CPT is strongly correlated with R_{70} with a coefficient of -0.8042. The hierarchical clustering analysis resulted in a revised risk ranking: Low (R_{70} < 0.4 °C/hr, CPT > 151 °C), Medium (0.4 °C/hr < R_{70} < 3 °C/hr, 130 °C < CPT < 151 °C), High (3 °C/hr < R_{70} < 11 °C/hr, 102 °C < CPT < 130 °C), Very High (R_{70} > 11 °C/hr, CPT < 102 °C).