Developing a lab-scale testing method for intumescent coatings

Beril Oguz, Emil Lidman Olsson, Jochen A.H. Dreyer, Kim Dam-Johansen

CoaST, Department of Chemical and Biochemical Engineering, Technical University of Denmark (DTU), 2800 Kgs. Lyngby, Denmark

Phone: +4550324388, Email: berog@kt.dtu.dk

Intumescent coatings, favored for their aesthetics, easy application, and flexibility, serve as a prominent passive fire protection method. Expanding up to 100 times their original thickness, they create a thermally insulating layer, protecting the substrate beneath[1]–[3].

To commercialize intumescent coatings, compliance to national/international fire safety standards is essential, typically necessitating testing in gas-fired industrial-scale furnaces. However, the cost and energy consumption of industrial furnaces make them impractical during the formulation development phase. Consequently, researchers employ lab-scale methods such as small electric furnaces, Bunsen burners, and cone calorimeters[4]. Yet, a significant challenge lies in the lack of direct correlation between lab-scale and industrial-scale results. Figure 1 is showing an example of how much the results may differ depending on the equipment used.

Our research aims to establish precise correlations, paving the way for a cost-effective and energy-efficient testing method.

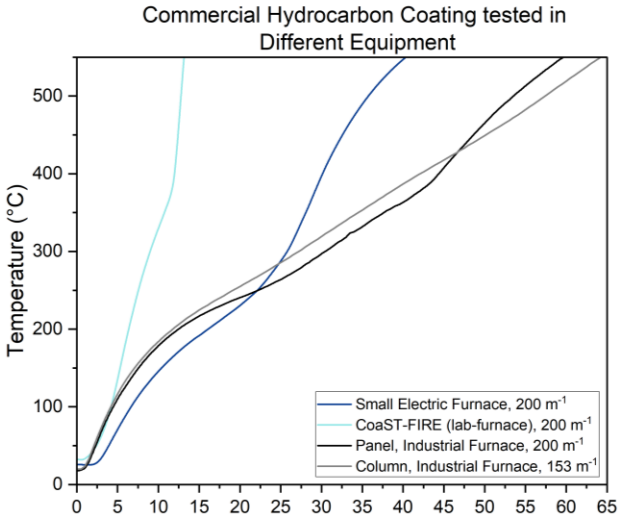

Figure 1. Temperature of steel samples protected by the same coating but tested in different equipment.

References

[1] B. K. Cirpici, Y. C. Wang, and B. Rogers, "Assessment of the thermal conductivity of intumescent coatings in fire," *Fire Saf. J.*, vol. 81, pp. 74–84, Apr. 2016, doi: 10.1016/J.FIRESAF.2016.01.011.

[2] K. P. Nørgaard, K. Dam-Johansen, P. Català, and S. Kiil, "Investigation of char strength and expansion properties of an intumescent coating exposed to rapid heating rates," *Prog. Org. Coatings*, vol. 76, no. 12, pp. 1851–1857, 2013, doi: 10.1016/j.porgcoat.2013.05.028.

[3] M. Morys, D. Häßler, S. Krüger, B. Schartel, and S. Hothan, "Beyond the standard time-temperature curve: Assessment of intumescent coatings under standard and deviant temperature curves," *Fire Saf. J.*, vol. 112, no. January, 2020, doi: 10.1016/j.firesaf.2020.102951.

[4] J. A. H. Dreyer, C. E. Weinell, K. Dam-Johansen, and S. Kiil, "Review of heat exposure equipment and in-situ characterisation techniques for intumescent coatings," *Fire Saf. J.*, vol. 121, no. October 2020, 2021, doi: 10.1016/j.firesaf.2020.103264.