

## **A MACHINE LEARNING-BASED GREY GAS EMISSIVITY MODEL FOR H<sub>2</sub>O-CO<sub>2</sub>-CO-N<sub>2</sub> MIXTURES**

Wei Chen, Tao Ren\*

China-UK Low Carbon College, Shanghai Jiao Tong University, Shanghai, China, 201306

**ABSTRACT.** Accurate prediction of the total gray gas emissivity is important for many engineering applications where the radiative heat transfer between gases and wall surfaces needs to be estimated quickly. In this work, we propose a machine learning approach for predicting the total gray gas emissivity of mixtures of H<sub>2</sub>O, CO<sub>2</sub>, CO, and N<sub>2</sub> at a range of pressures. The model was trained using a dataset generated from the HITEMP-2010 spectroscopic database, and the Alberti-cut-off line-shape model was used to calculate the absorption coefficients and total gray gas emissivity. Our model demonstrated good accuracy, with a maximum relative error of less than 2.2 % and a relative error of no more than 0.603 % for 99.73 % of the thermodynamic states within the input range. Additionally, our model is compact, easy to use, and outperforms traditional methods that rely on interpolation from two-dimensional look-up tables and empirical correlations for mixtures. The developed machine learning based emissivity prediction model is uploaded and made publicly available on GitHub at [https://github.com/TaoRen-Rad/MLP\\_emissivity](https://github.com/TaoRen-Rad/MLP_emissivity).

---

\*Corresponding Tao Ren: tao.ren@sjtu.edu.cn