



**UNIVERSITÀ
DI TRENTO**
Dipartimento di
Ingegneria Industriale

DII

Seminar



Multi-objective Optimization Using Genetic Algorithms and Machine Learning: A Case Study on Ion Exchanged Glasses

2nd October 2024, h. 11:30

Room A211, Polo Ferrari 1 - Via Sommarive 5, Trento

Speaker: Omid Banapour Ghaffari, School of Material Science and Engineering, Iran University of Science and Technology, Tehran, Iran

In this presentation, we propose a novel computational framework for the inverse design of ion-exchangeable glasses, focusing on the simultaneous maximization of depth of layer (DOL) and surface compressive stress (CS), two properties of ion-exchangeable glasses that often conflict. Conventional experimental methods for achieving this balance are time-consuming, costly, and present practical challenges. To address these limitations, we introduce an approach that integrates a multi-objective genetic algorithm with machine learning models. These models, trained on a diverse dataset of glass compositions, predict DOL and CS, guiding the genetic algorithm to maximize both properties simultaneously. Furthermore, physics-informed parameters refine the model, enabling more efficient exploration of the design space. This computational method offers a faster, more cost-effective alternative to traditional experimentation, significantly advancing the design of glass materials. While the focus is on the proposed computational strategy, the results confirm its ability to uncover essential relationships between compositional and process variables. Although this approach is applied here to solve the ion exchange problem, it can be adapted for use in other fields, serving as a versatile template. Its structure allows for flexible integration across various domains, making it a broadly applicable tool for complex optimization challenges.

Info

Email: comunicazione.dii@unitn.it

Local contact: vincenzo.sglavo@unitn.it

www.dii.unitn.it