
Contribution ID: **200** Type: **Oral**

# Machine Learning-Driven Analysis of MXene Research: Trends, Applications, and Future Directions in 2D Materials

The growing demand for sustainable materials has intensified the research into Two-dimensional materials, with MXenes emerging as a promising material across various industries due to their exceptional properties. 2D materials have been in the research spotlight from past decades due to their unique physical and chemical properties. They attracted significant interest in various domains such as energy storage, sensing, catalysis and many more due to their large surface area, electron confinement, and unique morphology. In this study, author has reviewed approximately 2000 papers from past one decade published on MXenes with various material composition and applications. Utilizing AI tools and advanced machine learning techniques, author has made in-depth analysis by processing and clustering research abstracts allowing for the extraction of patterns and trends in MXene research.

Clustering has been done based on material composition, such as transition metals in the place of M and non-metals in the place of X with their applications in various domains. In particular, sensor applications including biosensor, chemical sensor, gas sensor, optical sensor, pressure sensor have been analysed in detail. Based on the analysis, author has highlighted key trends, such as the increasing applications of MXene hybrids in enhancing optical and catalytic properties. Compositions like Titanium, Niobium, Tantalum transition metals with carbide or nitride were most often used focusing on high-performance energy storage, environmental remediation technologies and sensing. This analysis and visualization approach has enabled us to identify emerging areas, providing insights into the future direction of research on MXene materials. Overall, our review and findings highlight the growing potential for future research on MXenes materials in cutting-edge applications.

**Primary author:** Mr H R, Dr. Deepa (School of Sciences, Jain University)

**Co-author:** Mr R SHANKAR, Saatvick (PES University)

**Presenter:** Mr H R, Dr. Deepa (School of Sciences, Jain University)

**Track Classification:** Innovation and Technology for Sustainability