

Nanostructured Composites of 2D Materials and Proteins: A Patent Landscape Analysis

Massimo Barbieri

Politecnico di Milano, Technology Transfer Office, Milano, Italy

<https://orcid.org/0000-0002-7409-5861>

Abstract

The objective of this study is to provide a patent landscape analysis of 2D nanomaterial/protein composites. Espacenet was selected as a reference patent database for two primary reasons. Firstly, its use does not incur any licensing fees, thereby enabling researchers to effortlessly reproduce the datasets. Secondly, its comprehensive coverage ensures that researchers can access a vast repository of information on inventions and technological advancements from 1782 to the present. Notably, Espacenet offers free access to over 150 million documents, making it a valuable resource for academic and industrial research.

A combination of keywords and classification symbols was used in the execution of the patent searches. The classification symbols employed included the International Patent Classification (IPC) and the Cooperative Patent Classification (CPC). The aforementioned classification symbols were incorporated into the Title/Abstract/Claims and All Text search fields.

The datasets obtained were then subjected to analysis in terms of filing trends, the type of 2D nanomaterial used, priority countries, and the type of claimed proteins.

Datasets can serve as a valuable instrument in the realm of business intelligence within the context of the technology transfer process. Additionally, they can be used as a basis for carrying out prior art searches.

In this final instance, it is recommended that a search be conducted across multiple databases. This approach is advised to ensure a more comprehensive exploration of the subject matter.

Graphene, transition metal dichalcogenides (TMDCs), layered double hydroxides (LDHs) and graphene oxide (GO) are the most claimed 2D nanomaterials. In contrast, hexagonal boron nitrides (hBNs) and MXenes, despite being less frequently cited, have exhibited a marked increase in the number of recent filings.

Only a single patent application has been identified for both g-C₃N₄ and metallenes, in particular a bismuthene-PEDOT:PSS-silk protein composite hydrogel.

With regard to proteins, considerable variability is observed, contingent upon the 2D material utilized. However, a review of patent documents reveals that the most frequently cited proteins include silk, gelatin, albumin, soy, collagen, and bovine serum albumin (BSA).

China has the highest number of filings, followed by the USA, Europe, Japan, and South Korea.

Keywords

Patent information; patent search; patent landscape analysis; 2D nanomaterials; proteins; nanostructured composites