

# Biomimetic hydrogel-based electronic skin: An overview based on patent analysis

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## Introduction

One major challenge for electronic skin (e-skin) is the need for soft and stretchable electronic materials, as conventional materials present limited functionality, low surface adhesion, and relatively high power consumption. The development of skin-like hydrogel devices introduces an additional challenge, such as low ambient stability, because of their sensitivity to environmental conditions. Research and development are making progress in addressing these challenges, and there have been notable advancements in the field of biomimetic hydrogel-based e-skin. Innovation in this area has the potential to pay off. Organizations that invest in and develop innovative e-skin technologies based on biomimetic hydrogels can secure intellectual property rights through patents. In this regard, this work is dedicated to reviewing the state-of-the-art by presenting what has been patented concerning biomimetic hydrogel-based e-skin.

## Methods

Different patent databases were employed, utilizing diverse sets of keywords and associated terms. Searches were carried out and based on patent titles, abstracts, and claims to ensure comprehensive coverage and retrieval of relevant information. The search was then filtered regarding publication year, jurisdiction, and patent classifications.

## Results

The inception of biomimetic hydrogel-based e-skin patenting can be precisely traced back to the earliest priority date, pinpointing 1988 as the commencement year. Notably, the zenith of patent document activity occurred in 2013 and 2021. Analysis reveals that the United States and China stand out as the most prolific nations in patenting biomimetic hydrogel-based e-skin. The majority of inventions pertaining to biomimetic hydrogel-based e-skin, specifically designed for hydrogels or hydrocolloids for use in prostheses or as coating chemical sensors, are distinguished by their functional attributes and physical properties.

## Conclusions

This work, which offers a competitive analysis spanning trends in biomimetic hydrogel-based e-skin, provides several recommendations aimed at guiding the formulation of innovative research strategies.

Keywords: e-skin; hydrogels; biomimicry; innovation; patent