

■ Proposal for a Standardized Taxonomy of Hemp-Derived Carbon Materials (HDCM)

With the Formal Naming of *Mitlinite*

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Abstract

The rise of hemp-derived carbon materials presents an urgent need for precise scientific nomenclature. Current discourse suffers from ambiguity, with terms like “hemp graphene” or “hemp-derived nanosheets” used inconsistently. This paper proposes a systematic taxonomy — Hemp-Derived Carbon Materials (HDCM) — to categorize carbon morphologies from hemp. Furthermore, it introduces the formal material name Mitlinite to describe the graphene-like nanosheet carbon first pioneered by Dr. David Mitlin in 2014. Establishing standardized terminology will accelerate academic communication, industrial scaling, and sustainable material innovation.

1. Background

Carbon materials occupy a foundational role in modern technology. Well-defined allotropes (graphite, graphene, diamond, fullerenes) and engineered materials (PAN-based carbon fibers, reduced graphene oxide) are named and standardized. By contrast, biomass-derived carbons — particularly from hemp — remain linguistically inconsistent. Dr. David Mitlin’s landmark 2014 work demonstrated that hemp hurds can yield graphene-like nanosheets with electrochemical performance rivaling reduced graphene oxide. Yet the label “hemp graphene” has persisted, creating confusion between hemp-derived carbons and true graphene allotropes.

2. Taxonomy Framework: Hemp-Derived Carbon Materials (HDCM)

We propose a three-class system based on origin, structure, and morphology: **2.1 Hemp Carbon Fibers (HCF)**

- Source: Hemp bast fibers.
- Form: Filamentous carbons, stabilized, carbonized, or graphitized.
- Subclasses:

HCF-S → Stabilized (200–300 °C)

HCF-C → Carbonized (800–1200 °C)

HCF-G → Graphitized (>2000 °C)

2.2 Hemp Carbon Nanosheets (HCN)

- Source: Hemp hurds/lignin.
- Form: 2D turbostratic, graphene-like nanosheets.
- Subclasses:
HCN-P → Porous nanosheets
HCN-G → Graphitic nanosheets
HCN-F → Functionalized nanosheets

2.3 Hemp Biochar (HBC)

- Source: Whole hemp biomass.
- Form: Amorphous porous carbons, micro- to macroporous.
- Subclasses:
HBC-A → Activated biochar
HBC-M → Mesoporous biochar
HBC-MF → Magnetic/functionalized biochar

3. Formal Naming of Mitlinit

To resolve ambiguity in reference to Mitlin's discovery, we propose the material be formally recognized as: **Mitlinit (HCN-M)**

- Definition: A hemp-derived, turbostratic, graphene-like carbon nanosheet produced via pyrolysis of hemp lignin, with high surface area (up to ~800 m²/g), enhanced electrical conductivity, and demonstrated application in electrochemical energy storage.
- Etymology: Named in honor of Dr. David Mitlin, who pioneered the first demonstration (2014).
- Classification: Subclass of Hemp Carbon Nanosheets (HCN).

4. Implications

1. Academic Rigor — Enables consistent citations, avoiding conflation with graphene allotropes.
2. Industrial Adoption — Provides clarity for commercialization, patents, and regulatory filings.
3. Sustainability Leadership — Positions hemp-derived carbons as a legitimate, categorized field alongside PAN-based and petroleum-derived carbons.
4. Historical Credit — Honors Mitlin while giving the broader community a framework for future discoveries.

5. Call to Adoption

We recommend the adoption of HDCM taxonomy in academic, industrial, and policy contexts. Specifically, we propose that the nanosheet material discovered by Dr. Mitlin's group be henceforth referenced as Mitlinit (HCN-M). This initiative provides the field of sustainable carbon materials with the linguistic precision required for global scaling and positions hemp as a scientifically mature source of next-generation carbons.

Conclusion

Carbon science advances when nomenclature is standardized. Just as “graphene” and “fullerene” clarified their respective discoveries, “Mitlinite” and the broader HDCM taxonomy will clarify hemp-derived carbons. Through this proposal, we lay the foundation for systematic study, commercialization, and the acceleration of the organic materials revolution.