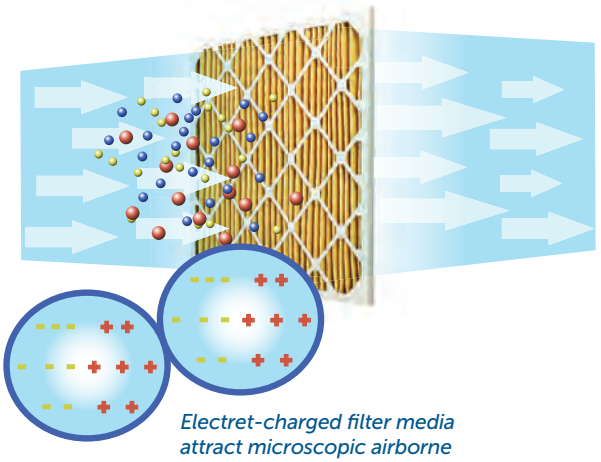
Electret-Charged Media: Harnessing A Fundamental Force of Nature for Superior IAQ

Electret Charging Explained

They're probably better known than they are understood. First observed by the ancient Greeks, and available commercially since 1930 with the introduction of the Hansen resin-wool filter, electrets today are found in a variety of filtration applications.



Electret-charged filter media attract microscopic airborne particles in much the same way a magnet attracts iron particles.

Generally, the preferred electret charging technique depends on the composition of the media. For example, **triboelectric charging** results from frictional contact between two uncommon surfaces. This method has limited application with electret filter media. **Hydrocharging** employs a high-pressure water jet directed through a nonwoven filter media. However, improper drying of a hydroentangled media can lead to a loss of charge or to filter contamination.

Corona charging is generally considered the best method for large-scale production of electret filter media. A corona is an electrical discharge between two electrodes of opposite polarity. The ions and electrons generated can be deposited on any insulating material passed through the discharge. The resulting distribution of charge is usually not consistent through the media structure, resulting in highly non-uniform electric fields within the filter. This enhances the media's ability to capture airborne particulates.

Today, most electret filter media is filament-based and is made using one of a number of nonwoven forming techniques. Since this media relies on electret charge as well as mechanical filtration, the filter media fibers can be packed less densely than with conventional filter media, thus providing less resistance to airflow.

The most significant benefit of electret-charged filter media is the ability to remove very small particles below one micron in diameter while maintaining a low pressure drop (i.e., airflow resistance). These sub-micron particles are much smaller than the void spaces present in most commercial electret media, yet due to the electrostatic forces within the media structure, they are removed with high efficiency.

Electret Charge Misconception

Contrary to common assumptions, a filter media's electret charge is not affected by either humidity levels or long-term storage. In fact, charged electret media perform well under a number of ambient challenges and outperform both alternately charged media and mechanical-only media alternatives.

Testing has shown that, even at 80 and 90 percent relative humidity, the filtration efficiency of electret-charged media is unaffected.

Testing has also shown that long-term storage has no effects on the filtration properties of electret-charged media. In one test, electret-charged media was stored in a non-temperature controlled warehouse in the Southeastern U.S. and checked at one- and two-year intervals. No significant difference in filtration efficiency was observed after one year of storage, while only a small decrease efficiency (only for particles in the 0.3 to 0.9

Did You Know?

An electret media's charge becomes part of the media's structure and cannot be isolated from its structure to determine its efficiency without impacting other filtration mechanisms.

micron range) was observed after two years. In another test, electret-charged filter media was exposed to accelerated aging at 130F for six weeks. No significant change in filtration efficiency was observed.

In fact, even 10 years after production, certain electret-charged filter media continues to deliver strong filtration efficiency, according to one continuing aging study.

Balanced Approach is Key

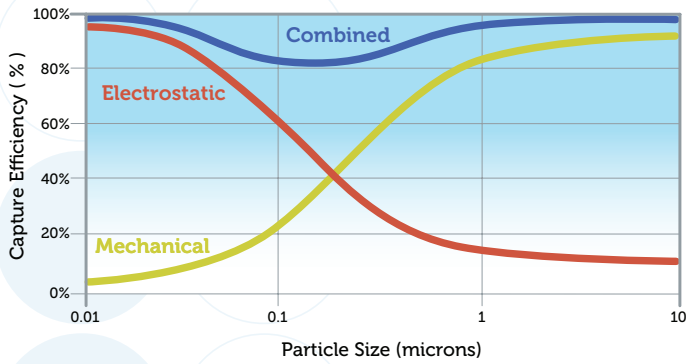
The performance of any electret media depends upon its structure, its charge (including the pattern or distribution of charge) and the relationship between the two. This means that not all electret filters are created equally.

A nonwoven filter media that uses a combination of mechanical structure and electret charge provides a means of achieving high initial efficiency (due mostly to the charge) and sustained high efficiency (mostly due to the structure). As the filter captures small particle contaminants in situ, the contaminants will begin to reduce the available charge in the media. However, as this occurs, these captured contaminants are having the net effect of enhancing the filter's mechanical filtration efficiency. This balanced approach allows filters utilizing electret media with a gradient density structure to provide optimal filtration and energy efficiency over its useful life.

Keep in mind that filters that have poor mechanical performance and rely too heavily on electrets can lose efficiency in some cases. Examples of these special cases include 100 percent outdoor air or environments with oily mists. Well-designed mechano-electret filters, on the other hand, employ a balance of mechanical and electrical properties to deliver high initial efficiency, high efficiency for fine particles, and sustained efficiency over the life of the filter. Plus, they do it at lower airflow resistance than mechanical-only filters.

Thanks to their lower airflow resistance and reduced energy consumption, mechano-electet filters can also help reduce greenhouse gas generation – a wise sustainability strategy.

Mechano-electret Performance



The best filter is a good mechanical filter augmented with an electrostatic charge

Bottom Line for Facility Managers and HVAC Professionals:

Using filters that combine an electret charge with a robust mechanical filtration structure can help improve your building's indoor air quality while simultaneously managing costs.

Bottom Line for Filter Distributors and Filter Manufacturers:

All electret-charged filter media is not the same. Indeed, the synergy of the web structure and charge distribution can make a big difference in terms of performance.