**Preparation of High Loft Electrically Conductive Activated carbon Web from Acrylic Waste for EMI Shielding Applications**

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**Extended Abstract**

**Introduction**

In recent years, research on electromagnetic interference (EMI) shielding materials has attracted significant attention due to increase in electromagnetic population from widespread applications of computer and telecommunication technologies [1, 2].For eco-friendly advancements in EMI shielding effectiveness,the development of new light weight shielding materials havingstrong absorption and weak secondary reflection is necessary. This can be achieved by porous morphology, large specific surface area and higher electrical conductivity of shielding materials [3,4].Although number of research studies focused on developmentof porous carbon based EMI shielding materials, the construction oflightweight structures with excellent EMI shielding properties bysimple and affordable method is still a big challenge. This workpresented the simple and novel method for preparation of porousand electrically conductive activated carbon nonwoven web fromacrylic fibrous wastes. The prepared activated carbon is advantageous over carbon made from other materials because of low cost,high density, better purity, and virtually dust-free nature of acrylicfibers [5].

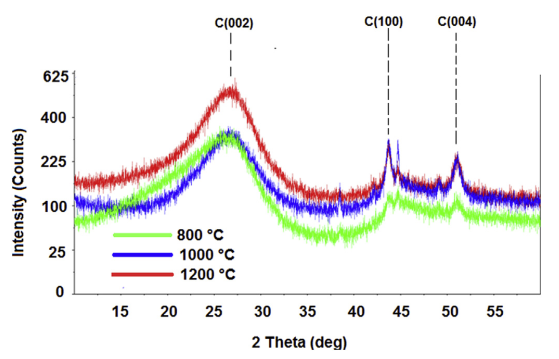
The activated carbon web was prepared by sequentialaction of carding, thermal bonding with bi-component fibers and physical activation of acrylicfibrous web in presence of air. The carbonization was performedunder the layer of charcoal at 800 oC, 1000 oC and 1200 oC with theheating rate of 300 oC h-1 and without any holding time. Further,electrical conductivity, EDX, X-ray diffraction, SEM, X-ray tomography and BET analysis was carried out to study the effect ofcarbonization temperature on physical and morphological properties of activated carbon web. At the end, the electromagneticshielding ability of the produced three webs was investigated with  
respect to change in carbonization temperature and thickness ofmaterial using two different measurement approaches (i.e. waveguide method and coaxial transmission line method).

**Results and Discussion**

The physical properties of acrylic fibrous and high loft activated carbonnonwoven webs were determined in terms of shrinkage, flexibilityand dusting tendency as can be seen from table 1. The techniques of X-ray diffraction (XRD) analysis, Energy dispersive x-ray (EDX) analysis and Scanning Electron Microscopy were performed for in depth analysis of high loft AC webs prepared at different temperature.

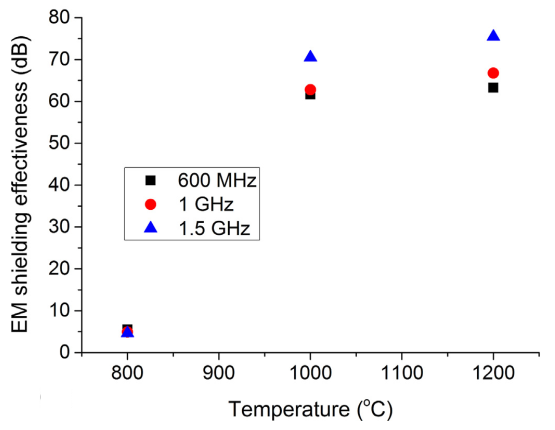
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| **Effect of carbonization temperature on physical properties of high loft AC web** | | | | |
| Temperature (oC) | Yield (%) | Shrinkage | Flexibility | Dusting |
| 800 | 61.7 | Good | Good | Good |
| 1000 | 57.6 | Good | Average | Average |
| 1200 | 45 | Average | Poor | Poor |

The electrical conductivity and EMI shielding was found to increase as the temperature for carbonization was increased. The higher EMI shielding results came from AC web prepared at 1200 oC (around 70 dB) because at high temperature more parallel orientation of chains and high degree of crystallinity as can be seen from figure 1.



**Fig 1. Effect of carbonization temperature on crystallinity of AC webs**

The range for EMI shielding for activated carbon webs prepared at different temperatures can be seen from figure 2. The EMI shielding was checked at three different frequencies (600MHz, 1 GHz, and 1.5 GHz).



**Fig 2. Effect of frequency on EM shielding effectiveness of AC webs**

**Conclusion**

The present study was focused on development of porous andelectrically conductive activated carbon based electromagneticshielding materials from acrylic fibrous wastes. The simple andnovel approach was employed to introduce absorption and reflection properties of electromagnetic radiations into the shieldingmaterials. This was achieved by physical activation of thermal bonded high loft nonwoven web of acrylic fibers.

**References**

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