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Magnetization and XPS Study of Desert Sand in Connection with Cell Phones Signals

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Abstract: Magnetization and XPS measurements of desert sand collected from areas surrounding the busy town of Dubai has revealed iron oxide content. Iron oxide such as Fe_3O_4 is magnetic and could resonate with cell phone signals. If inhaled, the resonating iron oxide particles inside the lung may introduce health hazards. Cell phones are greatly used in Dubai and the surrounding areas. Winds make the sand airborne and the possibility of inhaling it by the people is high. Beside the normal problems associated with inhaling sand particles, we argue that the consequences of inhaling the iron oxide containing sand in the cell phone era should not be ignored.

Keywords: Desert sand, Inhalation of iron-oxide, Cancer, XPS study.

Introduction:

We live in a high tech world and thus bombarded by all kind of electromagnetic waves with host of frequencies. Magnetic particles can absorb these electromagnetic waves through resonance. For example, it is known that the magnetic material known as Magnetite (Fe_3O_4) is by far a much better absorber of microwave radiation than any biological material in the 0.5-10 GHz frequency range through the process of electromagnetic resonance.[1] The frequencies currently used in the cellular telephone industry are in the frequency range mentioned above. Energy absorbed by this process could be dissipated in the cellular structures in close proximity to the magnetite particle causing a possible tissue damage. Leleu et. al.[2] and Hilger et. al.[3] found that if magnetite is injected in the liver, considerable heat is induced when an alternating magnetic field is applied. This magnetically induced heating could cause severe tissue damage. Thus we should be aware about the magnetic particles that enter our body, say by breathing, as they may resonate with the alternating magnetic field of the cell phone signals.

In the U.A.E., Dubai and Abu-Dhabi (DA) metropolitan areas are bordered by the Arabian Desert. The people of the DA area breathe a considerable amount of dust/sand from the desert and there is heavy use of cell phones by the public. The respiratory disorders were the second most common condition in the UAE in 2010.[4]

Though particulate air pollution is usually associated with increased mortality and morbidity, the mechanisms by which these particulate matter PM affects pulmonary functions have not been identified. And any correlations of magnetite particles with other PM components were not established.

Experiments and Results:

We collected sand samples from three areas at depths of about 10 cm into the ground. One sample is near Sharja region which is about 10 miles North-East Dubai. The second sample is from an area between Dubai and AbuDhabi, about 40 miles South-West Dubai. The third sample is from an area about 90 miles south of Dubai between Abu Dhabi and Al-Ain towns. Each sample was put in a Superconducting Quantum Interference Device (SQUID) magnetometer and the magnetization M was measured as a function of the magnetic field H at room temperature. As shown in Figure 1, the three samples are magnetic and basically have the same behavior.

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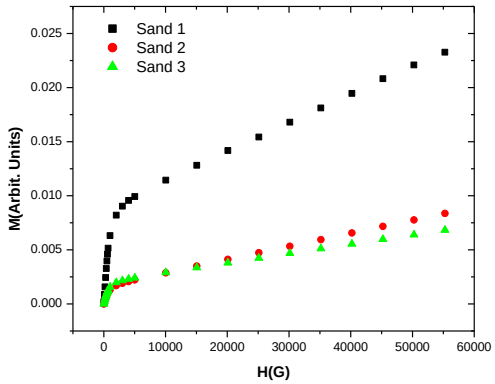

Figure 1: Magnetization verses the magnetic field at room temperature for the three sand samples. Sand 1: Dubai-AbuDhabi sand; Sand 2: Sharja sand; Sand 3: AbuDhabi-AlAin sand.

We then took sample 2 which is the Sharaja sample and placed it in the SQUID and cooled it in zero-magnetic field from room temperature to 5 K. Then, a magnetic field H of 200 G was applied and the magnetization M was measured while the temperature T was raised from 5 to about 330 K. This magnetization curve, usually called the zero-field-cooled curve (ZFC), is shown in Figure 2. As shown, the ZFC curve has a distinctive peak around 120 K proving the existence of magnetite. It is known that one of the important mark of magnetite is the presence of Verwey transition near 120 K.[5,6]

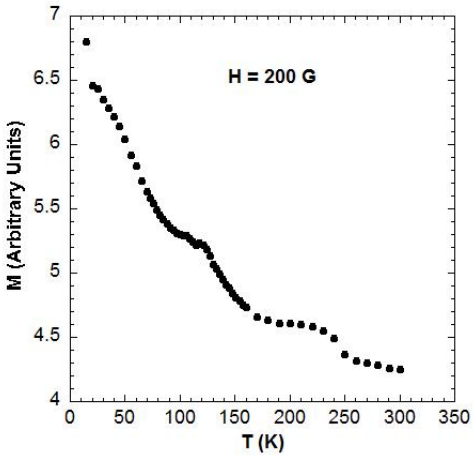

Figure 2: The magnetization M versus temperature T at 200 G magnetic field of Sand 2 after zero-field cooling.

XPS study:

One can argues that magnetite may exist deep inside the sand particle covered by Si and thus the Si shell will protect the lung tissue from the resonating effect of the magnetite with the cell phone signal. To see whether magnetite exists on the surface of the sand particles, we conducted X-ray Photoelectron Spectroscopy XPS measurement on the three sand samples. XPS technique investigates approximately 50-100 angstrom deep giving it the ability to study surfaces of materials. Surface analysis by XPS involves irradiating a solid in vacuum with mono-energetic soft x-rays and analyzing the emitted electrons by energy. The mean free path of electrons in solids is very small; the detected electrons originate from only the top few atomic layers of the sample. This is the reason why the XPS makes a unique surface-sensitive technique for chemical analysis. Quantitative data can be obtained from peak heights or peak areas using atomic sensitivity factors within 10 –20 % error.[7]

We conducted XPS measurements on the three sand samples and the results are shown in Figure 3. We found peaks of iron and oxygen indication iron oxides. The atomic percentage of Fe on the surface is 1.5 %, 1.6% and 1.8% which is basically the same for the three samples. This suggest that the iron oxide is present at the surface of the sand particles.

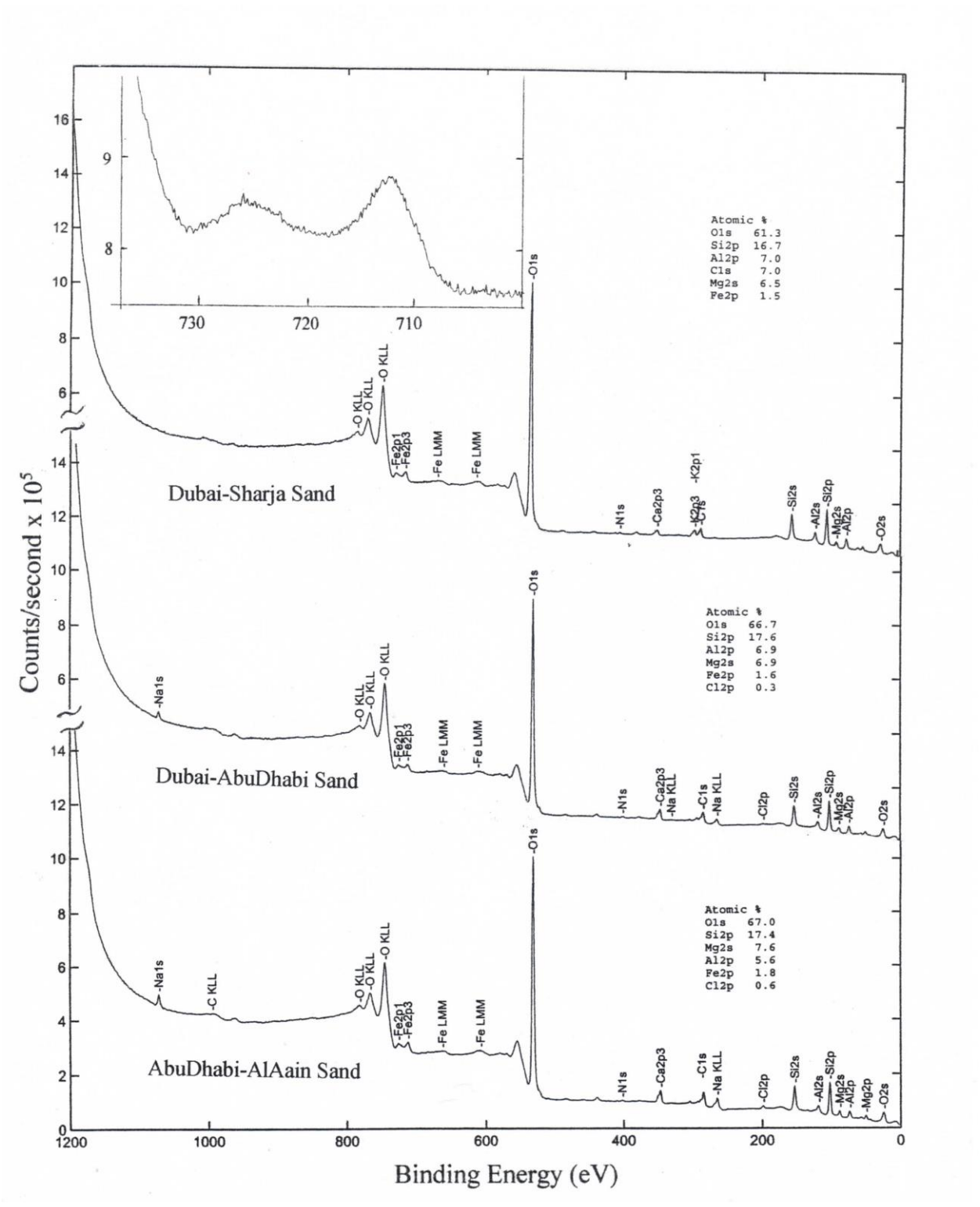

Figure 3. XPS spectra of the three send samples. The zoom-in inset is of the iron peaks of the Dubai – Sharja sand.

Conclusion:

We proved that the sand collected from the area surrounding Dubai and near Abu-Dhabi and Al-Ain towns contain iron oxides. These are three major cities in the UAE where people are generally well-off and have cell phones. As sand particles enter the lung during breathing, they cause the known health hazard as foreign objects. But the presence of magnetite in the sand particles may cause an additional health risk in the cell phone era that our grandparents never experienced. Magnetite resonate with cell phone signals as well as with many electromagnetic signals in the frequency range of 0.5-10 GHz such as the Wi-Fi signal. A study is needed to examine the amount of magnetite in the lung tissues of people who deceased because of lung complications in towns in or near the Arabian Desert.

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