

Chapter One

Background, Materials & Process

In this chapter, machine olfaction device (MOD) basic outline is presented in the form of a discussion and analysis of the various aspects related directly or indirectly to the device. In addition, a brief historical background covering early discussion and development in this field also presented, while the mechanisms for detecting and dealing with gases, odour and aroma from the 20th Century and up to recent developments presently taking place.

An outline related to problems and solutions relevant to present days device design is considered as part of various general factors related to the MOD design. Furthermore, sensors and gas systems, plus polymer and manufacturing process are presented together with other relevant materials connected to the processes and functions of the above device.

1.1 Introduction

Within the development of various technologies worldwide, humans are trying, by the application of appropriate technologies, replicate the function of the five senses they possess. For example, artificial tasting (Electronic tongue or eTongue) and artificial smelling (electronic nose or eNose) are some of the modern developments which researchers and technologists at various companies and research institutes are competing for more reliable and accurate output results. MOD present technology detecting an odour, which can be either for one specific type of substance or for more than one substances, can be achieved only if all the components of the device are working correctly, regardless of the local environment surrounding the device. A good understanding of the chemical structure of a substance can help greatly in achieving this. In a way, the principle of sensing a certain type of odour by MOD can be compared to the outcome of smelling an odour, i.e. an airborne polar molecular travelling to our nasal cavity to be

sensed by our olfactory system. The function of MOD is trying to achieve something similar.

In this chapter, a general approach to the MOD system is provided with some additional details, whenever the need arises for further explanations.

1.1.1 Brief Historical Background

In 1914, Alexander Graham Bell was addressing a graduating class of the Friends' School in Washington, D. C. and during his speech, he made the following statements:

“Did you ever try to measure a smell? Can you tell whether one smell is just twice as strong as another. Can you measure the difference between one kind of smell and another. It is very obvious that we have very many different kinds of smells, all the way from the odor of violets and roses up to asafetida. But until you can measure their likenesses and differences you can have no science of odor. If you are ambitious to found a new science, measure a smell. What is an odor? Is it an emanation of material particles into the air, or is it a form of vibration like sound? If you can decide that, it might be the starting point for a new investigation. If it is an emanation, you might be able to weigh it; and if it is a vibration, you should be able to reflect it from a mirror. Can you reflect a smell or measure its velocity of transmission? If you can do those things you will be well advanced on the road to the discovery of a new science.”

What Bell was describing as a “discovery of a new science” is already an established technology in different parts of the world; however, the historical background related to the MOD actual research did not began earnestly until the middle of the last century. One of the first researches which can be related to MOD, is the making of the first gas sensor by Hartman in 1954, followed in 1961 by Mocrief in the form of array of 6 thermistors. Having said that, the first Electronic Nose was not eventually achieved until 1982 by Persaud and Dodd. Further research followed in 1985 via Hitachi Research Laboratory in the form of array for odour quality. In general, sensors and sensor arrays in the form of

devices, the name “Electronic Noses” first associated with them by Gardner and Bartlett in 1994 (Gardner and Bartlet, 1994).