SIMS – All for one and one for all

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Since the origins of SIMS, almost nine decades ago, the field has evolved along distinct pathways where a process of natural selection has seen the emergence and decline of techniques as they, in turn, are superseded by new innovations. This has resulted in today's powerful SIMS instruments that are having extraordinary impact in almost every area of materials science and increasingly in the life-sciences [1]. However, independent evolutionary lineages, for example "dynamic SIMS" and "static SIMS" have led to segmentation of the community. Recent advances in instrumentation and advances in fundamental understanding are now beginning to show the prospects for evolutionary convergence, which provides the main tenet of this presentation; as a SIMS community we are stronger if we all support each other. Or as Alexander Dumas more eloquently puts it "*All for one, and one for all*" in his novel The Three Musketeers.

To put this in context, recent developments driven by a fundamental analytical challenge will be discussed. Techniques, like nuclear magnetic resonance, provide high confidence in identification but with limited information on localisation. Whilst techniques like electron microscopy, give high confidence in localisation but low confidence in identification. This has been termed the "molecular uncertainty principle" [2]. In 2017, NPL introduced the **OrbiSIMS** technology [3] with an objective to simultaneously provide molecular identification and localisation as close to this limit as possible. Since then, the number of OrbiSIMS instruments around the world has increased significantly and the **community** of users and range of applications has grown. In this presentation, we briefly introduce the OrbiSIMS and use examples of the applications in advanced materials [4] and life-sciences [5] to highlight a convergence of "static SIMS" and "dynamic SIMS" as some of the traditional barriers begin to disappear. In a look to the future, further advances in mass spectrometers are expected, for example multiple reflection Time of Flight analysers, ion mobility and other novel hybrid analysers as well as improved sensitivity using quantum detection. There has, perhaps, never been a more exciting time to be involved in SIMS fundamentals and applications.

References

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