Explosive and chemical threat detection by surface-enhanced Raman scattering: A review

Acts of terror and warfare threats are challenging tasks for defense agencies around the world and of growing importance to security conscious policy makers and the general public. Explosives and chemical warfare agents are two of the major concerns in this context, as illustrated by the recent Boston Marathon bombing and nerve gas attacks on civilians in the Middle East. To prevent such tragic disasters, security personnel must be able to find, identify and deactivate the threats at multiple locations and levels. This involves major technical and practical challenges, such as detection of ultra-low quantities of hazardous compounds at remote locations for anti-terror purposes and monitoring of environmental sanitation of dumped or left behind toxic substances and explosives. Surface-enhanced Raman scattering (SERS) is one of today's most interesting and rapidly developing methods for label-free ultrasensitive vibrational "fingerprinting" of a variety of molecular compounds. Performance highlights include attomolar detection of TNT and DNT explosives, a sensitivity that few, if any, other technique can compete with. Moreover, instrumentation needed for SERS analysis are becoming progressively better, smaller and cheaper, and can today be acquired for a retail price close to 10,000 US$. This contribution aims to give a comprehensive overview of SERS as a technique for detection of explosives and chemical threats. We discuss the prospects of SERS becoming a major tool for convenient in-situ threat identification and we summarize existing SERS detection methods and substrates with particular focus on ultra-sensitive real-time detection. General concepts, detection capabilities and perspectives are discussed in order to guide potential users of the technique for homeland security and anti-warfare purposes.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Nanoprobes, Chalmers University of Technology, Swedish Defence Research Agency
Contributors: Hakonen, A., Andersson, P. O., Schmidt, M. S., Rindzevicius, T., Käll, M.
Pages: 1-13
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Analytica Chimica Acta
Volume: 893
ISSN (Print): 0003-2670
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.06
Web of Science (2017): Impact factor 1.363
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.01
Web of Science (2016): Impact factor 1.74
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.94
Web of Science (2015): Impact factor 1.682
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.64
Web of Science (2014): Impact factor 2.003
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.74
Web of Science (2013): Impact factor 1.547
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 4.55
Web of Science (2012): Impact factor 1.747
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 4.62
Web of Science (2011): Impact factor 1.65
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Impact factor 2.083
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Keywords: Chemical warfare agents, Explosives, Nerve gas, Portable Raman spectroscopy, Surface-enhanced Raman scattering, Trinitrotoluene
DOIs: 10.1016/j.aca.2015.04.010
Source: FindIt
Source-ID: 274902846
Research output: Research - peer-review; Journal article – Annual report year: 2015