Based on the Natural Resources Canada Resource Center, I am interested in conducting excellent research in science and technology to better human experience in developing more efficient and safe materials for use. This is one economical approach of protecting our environment. The CanmetMATERIALS-Hamilton and Calgary for research in metals, materials for use in automotive applications, clean energy, pipelines, eco-materials is doing excellent work, and I think my chemistry knowledge will be useful in research and development to study a variety of materials. Other areas of interest are found in the Bitumen Production Program, Mining and Mineral Sciences Laboratory and CANMET Energy Technology Centre (CETC)-Ottawa for research in mineral processing, waste disposal, characterization, renewable energy, CO2 management, and transportation systems.

Research into design and development of new generation flame-retardants is essentially important as some brominated flame-retardants are phased out due to environmental issues. More studies are needed for the development of efficient and safe flame-retardants because of their wide range of applications in electronic devices, transportation, furniture, wire and cable and more. Synergism between flame-retardants can help to attain optimal flame retardancy in materials if flame-retardants are used in correct proportion. During combustion and flame propagation of materials without flame-retardants, it leads to production of tons of carbon dioxide, CO2 causing global warming or climate change. In the presence of flame-retardants, the CO2 generation is optimally reduced. Using safe flame-retardants, for instance, mineral flame-retardants, such as magnesium hydroxide, Mg(OH)2 and aluminum hydroxide, Al(OH)3, it leads to formation of harmless products, but it is not economical due to high loadings/wt% needed to attain optimal flame retardancy performance. In addition, at elevated temperature, their efficiency is drastically reduced. With the recent experience of analysis of brominated flame retardants using X-ray imaging, Underwriters Laboratory burn test, Scanning electron microscope with energy dispersive X-ray spectroscopy, Infra-red and Raman and more, design and applications of new materials will be explored to better research and development in Natural Resources Canada.

Research interests:

* Development of advanced materials, processes and fabrication techniques for the next generation vehicles, including incorporation of flame-retardants.
* Development of hybrid materials, new materials recycling technologies.
* Development of nanotechnology-based titanium dioxide photo-catalyst materials and highly corrosion-resistant materials.
* Development of safe and efficient flame retardants to reduce air emissions during material combustion process.
* Analysis and quantification of air emissions and flame effluents of materials with harmful effects on environment using spectrophotometry, gas chromatography mass spectrometry, Fourier transform infra-red, non-dispersive infra-red, evolved gas analysis. Detection and identification of air emission is achievable by coupling a thermal analysis instrument with a quadrupole mass spectrometer, Fourier transform spectroscopy or gas chromatography.
* Surface-mined and in-situ oil sands bitumen and conventional heavy oil using all the available methods such as Laboratory –based microscopy, X-ray tomography or diffraction imaging.

The research work of Prof. Dean Chapman at Canadian Light Source using analyzer based phase imaging is fabulous. With the X-rays penetrating the sample to the detector, I think his X-ray imaging technique produces the world’s best phase contrast image.