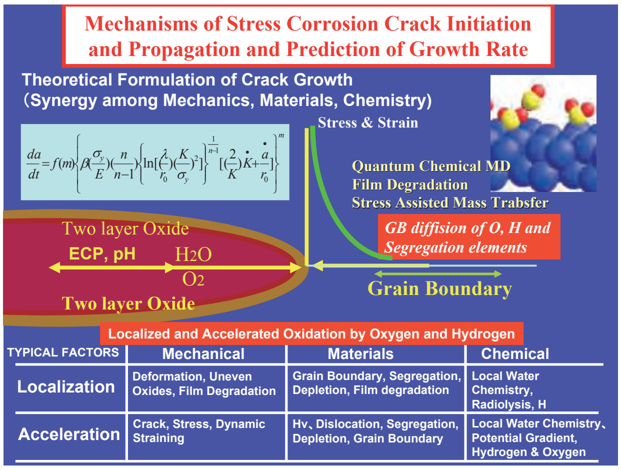
## Profile

Prof. Tetsuo Shoji received a PhD in Mechanical Engineering, Graduate School of Engineering, Tohoku University, was appointed as a research associate then promoted to associate professor in 1984 and to full professor in 1986. Since then, he has held various posts, such as director of the Fracture and Reliability Research Institute, member of the University Council, Vice-Dean of Engineering (research), and Executive Vice-President of University (research and international affairs). He was a postdoctoral fellow at the Department of Metallurgy and Materials Engineering, the University of Newcastle Upon Tyne, and a visiting professor of the Department of Nuclear Engineering, Massachusetts Institute of Technology. Since 2002, he has been an extraordinary member of the General Natural Resource and Energy Council, METI and a member of various committees of Nuclear and Industry Safety Agency under the Council. He is also involved in various international activities, such as serving as an expert member of the United States Nuclear Regulatory Commission “Proactive Materials Degradation Assessment” project, a member of Scientific Advisory Committee of the European Commission PERFECT Project and a member of the SCC-WG of Stress Corrosion Cracking and Cable Aging Project, OECD NEA. He has received 13 national awards, and 6 international awards including W. R. Whitney Award from NACE-International in 1998 and the Lee Hsun Award, Institute of Materials Research, Chinese Academy of Science in 2007. He is a member of the Engineering Academy of Japan and an associate member of Science Counsil of Japan .

## Research Activities

Prof. Tetsuo Shoji’s research field is the “Physics and Chemistry of Fracture”, combining mechanics and chemistry, so-called mechano-chemistry, which is necessary for the analysis of materials degradation and fracture mechanisms as an extension of strength of materials and fracture mechanics. This field has been receiving more and more concern from the point of view of a safe and reliable society, through a high quality safety system and the reliability of infrastructure, such as nuclear power plants and other energy conversion systems. For example, one of the factors degrading the safety and reliability in structures and components is crack initiation and propagation under the influence of chemical environments, and its mechanistic understanding is of extreme importance. By the use of better instrumentation and analysis, the following are his original works relating to the above problems: (1) Development of a recrystallization-etch technique and a unique evaluation procedure for crack tip intense strain region, by which ductile fracture can be quantitatively analyzed; (2) Proposal of a unique formulation of stress corrosion crack growth rate, based upon a mechanistic understanding of crack growth under a mechano-chemical reaction at a crack tip and its modeling. This proposal is the first proposal in the world giving a predictive capability of growth rate of stress corrosion cracking, taking into account both crack tip mechanics and chemistry; (3) Establishment of a predictive model and a capable procedure for aging degradation evaluation of plant components in energy conversion systems such as fossil and nuclear power plants and plant life time prediction and management. Based upon his varied original work, he also contributes to the establishment of a Center of Excellence for “Physics and Chemistry of Fracture”, focusing on mechano-chemical phenomena and its relevance to failure in the field of operating plants. He is one of the pioneering leaders in this research field.




## Message

My life work of physics and the chemistry of fracture originated during my research internship for 3 months one summer at one of the industrial research institutes when I was a first year PhD student working on Fracture Mechanics. During these days working on low temperature brittle fracture tests being performed near the extreme large capacity testing rig of 2,000 tonnes, I was exploring the laboratory keeping a pickled plum in my mouth, and met a typical cantilever type stress corrosion testing in sea water with a lot of salt and dirty rust on the specimens. At this moment, I received a strong message from the specimens that failure and / or fracture of structural components in service can gradually take place even at a lower stress than a design stress with the assistance of chemical environments. This encounter with stress corrosion was a crucial moment in determining my research field. I had to start to study the interaction of mechanics and chemistry, so-called Mechano-chemistry and also electrochemistry as a basis of corrosion. After struggling for several years, I succeeded with confidence in measuring an electrochemical polarization curve, and with my own hand made potentiostatt fabricated, based upon the electric circuit drawing provided by the circuit design office in the Institute of Materials Research (KINKEN). Both the late Prof. Emeritus Masahiko Suzuki and the late Prof. Emeritus Redvers Parkins had been encouraging me to challenge such a cross-disciplinary research field. The building up of continuous small challenges may lead to an innovative challenge and success in pioneering an original research field. I am still engaging with what I couldn’t complete in my challenge in the past. *Curiosity-driven challenge and serendipity will never come to an end as long as Diversity is fundamentally acknowledged.*