

Development of Knowledge Base System Linked to Material Database

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Background

The distributed material database system named "Data-Free-Way" which can be shared from the Internet has been developed under the collaboration of NIMS, JAERI, JNC, and JST. In the system, the retrieved results are displayed as tables and graphs, and the users judge the meaning of the retrieved results.

If the meaning of the retrieved results and the analyzed results are stored as knowledge, the system becomes more beneficial for many users. Therefore, in order to create additional values of the system, **knowledge base system**, in which knowledge extracted from the material database is expressed, is planned to be developed for more effective utilization of Data-Free-Way.







Present Status of Data-Free-Way - Status of stored data in four organizations -

Organization	Status of data input	Data					
	Creep, tensile and corrosion properties of superalloys at elevated temperatures in air, helium and hydrogen	1000					
National Institute for Materials Science (NIMS)	Creep and tensile properties of stainless steels	500					
	lechanical properties of Ni-based superalloys						
	Low-cycle fatigue and fatigue-crack-growth properties of low-alloy and stainless steels	1100					
	Mechanical properties of Alloy 800H, Hastelloy XR and Cr-Mo steels for high temperature gas-cooled reactor	1500					
Japan Atomic Energy Research Institute (JAERI)	Mechanical properties of AI-based alloys for research reactor	500					
	Mechanical properties of superalloys	200					
	Mechanical properties of irradiated stainless steels	900					
	Sodium-compatibility and irradiated properties of ceramics	1400					
lanan Nuclear Cuela Development lastitute (INC)	Lithium-/Potassium-corrosion and mechanical properties of metals	600					
Japan Nuclear Cycle Development Institute (JNC)	Mechanical properties of irradiated stainless steels	500					
	Properties and Lithium-/Potassium-compatibility of irradiated Nb-/Mo-based alloys	100					
Japan Science and Technology Corporation (JST)	Mechanical properties of irradiated stainless steels	5300					



Present Status of Data-Free-Way - Example of retrieval -



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Present Status of Data-Free-Way - Graphic function -





Present Status of Data-Free-Way - File conversion function -

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Spread sheet software (Excel)

Retrieved results

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Present Status of Data-Free-Way Example of image data -

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Present Status of Data-Free-Way Linkage function between numerical data and image ones

Image data can be obtained by clicking the datum point interested on the graph.









Description Method of Knowledge Extracted from Material Database - Conceptual design of knowledge base -

Material database (Data-Free-Way)

Standard type retrieval screen is prepared for users' convenience.

Knowledge base

If typical retrieved results through the standard type retrieval screen are available, users do not need to retrieve the database under the same conditions.

If the meaning of the retrieved results and the analyzed results are stored as knowledge, the system becomes more beneficial for many users.

Knowledge Note

Typical retrieved results through the standard type retrieval screen The meaning of the retrieved results







Description Method of Knowledge Extracted from Material Database - Knowledge note -

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Storing knowledge obtained as retrieved results, the items shown in the left side of the figure are described with XML. And a knowledge note can be displayed using XSL (eXtensible Style Language) as shown in the right side of the figure.



Description Method of Knowledge Extracted from Material Database - Knowledge note -

 Knowledge notes can be made at each stage of the data retrieval, the display of the retrieved results, or the graph making.

• A knowledge note consists of the table and the graph of the retrieved results, and description of the following items; the title, the register, the date of registration, the contents of retrieval, the knowledge document, and the references where the knowledge is described.

By describing knowledge obtained from the material database with XML, the system possesses the function of not only displaying the table nor the mere graph as the retrieved results but also displaying knowledge.



Description Method of Knowledge Extracted from Material Database - Knowledge note (Continue) -

•The user can easily convert the display form of the table and the graph into the data format which the user usually uses. Moreover, additional information to the retrieved numerical values such as a unit can be easily conveyed.

If such knowledge notes are made by many experts or researchers of materials and they are accumulated, effective knowledge base system can be constructed. As this knowledge base system is described with XML, the system can be shared in the world scale.

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Knowledge Note

Example of knowledge note (Knowledge note making)





Knowledge Note Example of knowledge note (Knowledge note making)

Knowledge information registration screen

Knowledge title	Relation between fracture elongation		
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Writer	Yoshiyuki KAJI		
Date	September 14, 2002	Name	Description
Purpose	Tensile properties of type 216 stainless steels under various test conditions	dfw 12545 xml	Relation between fracture elongation and uniform elongation for type 316 stainless steels Relation between uniform and fracture
Knowledge	the data in the group B are unirradiated ones and those in the group C are irradiated ones.	•	elongation in 316 stainless steels
ocuments	H. Fujita et al., Fusion Engineering and Design 51-52 (2008) 768-774		
Description of gra	ph Relation between uniform and fracture		

Description of knowledge obtained from Data-Free-Way



Knowledge Note

Example of knowledge note (Viewing knowledge note) -

Knowledge note reading screen

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Knowledge Note

Example of knowledge note (Viewing knowledge note)

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Knowledge Note

Example of knowledge note (Viewing knowledge note)







Summary

• The distributed material database system named "Data-Free-Way" which can be shared from the Internet has been developed under the collaboration of NIMS, JAERI, JNC, and JST.

In order to create additional values of the system, knowledge base system, in which knowledge extracted from the material database is expressed, is planned to be developed for more effective utilization of Data-Free-Way.

As the first step of the knowledge base development program, knowledge notes have been made where typical retrieved results through the standard type retrieval screen and the meaning of the retrieved results are described with XML.