Foundation: 1917 as Kaiser-Wilhelm-Institut für Eisenforschung

Since 1971: Basic corporate budget financed by Max-Planck-Society (50%) and VDEh (50%)

Budget 2012
(41% MPG, 38% VDEh, 21% third party funds)

Personnel: 250

100 years public-private partnership
...1998: P.N. – CEO, applications, transition

1999: M.S. and D.R. – directors board, basic science, construction

2004: J.N. – ab-initio, broadening, construction

2012: G.D. – in-situ, construction

Community: MPG Vice-president; German Science Council; Chairman Governors Board RWTH; Fachkollegiat DFG, ESF

Grants: Double ERC Advanced Grant, NanoMatFuture, ECCO2, Leibniz Award, AvH, 2 SFB

Education: >50 PhDs (10 y), 4 Habilitations, 8 Professorships, Azubi Award, best Azubi education (IHK)

Industry Outreach: > 1000 personnel (20 y), > 500 projects with industry (10 y): hydrogen, alloy design (mobility, energy), kinetics, thermodynamics, simulation, microstructure, damage, corrosion, coatings, magnetic materials

cites / ISI
(MPIE: personnel)

Age Distribution of Scientists (Oct. 2012)

- 28 in 25 to 29
- 35 in 30 to 34
- 18 in 35 to 39
- 9 in 40 to 44
- 3 in 45 to 49
- 2 in 50 to 54
- 2 in 55 to 59
- 0 in 60+

Other (102)

Germany (151)

Countries:
- China: 21
- India: 15
- Other: 102

Internationality:
- Austria: 5
- Brazil: 1
- Bulgaria: 1
- Cameroon: 2
- Canada: 1
- Chile: 1
- Colombia: 1
- Czech Republic: 3
- Egypt: 1
- Ethiopia: 1
- France: 3
- Greece: 2
- Indonesia: 1
- Iran: 5
- Iraq: 1
- Italy: 1
- Japan: 1
- Korea: 1
- Lebanon: 1
- Mexico: 1
- Netherlands: 1
- Nigeria: 1
- Pakistan: 3
- Russia: 7
- Spain: 1
- Sri Lanka: 1
- South Korea: 3
- Turkey: 4
- USA: 1
- Venezuela: 1
- Vietnam: 1
- Algeria: 1
- Ukraine: 3
- UK: 1
- Ukraine: 3

Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany

Team, Gender, Internationality
Scientific mission: complex materials in real environments

- multiple elements, phases, defects
- interacting mechanisms (non-linearity)
- kinetic transients / local equilibrium
- history dependent (synthesis, processing)
- multiple scales (modeling, experiment)
- real environments (systems science)
- multi-functionality
Complex Materials in Real Environments

Fields of competence for complex materials at the institute

Dierk Raabe
Martin Stratmann
Gerhard Dehm
Jörg Neugebauer
EXAMPLE

- hybrid vehicle
- soft magnet (hysteresis loss, eddy current)
- mechanical strength
- Cu nanoprecipitates in FeSi matrix
- crystalline magnetic anisotropy
- moving interfaces
- ....
MPIE structure and departments

Shareholder:
Max-Planck-Society MPG, German Steel Institute VDEh

Scientific Board

Trustees Board

Strategy Board

MPIE

Scientific Board

Gunther Eggeler (Fellow)
Mats Hillert (Extern. Member)
Reiner Kirchheim (Extern. Member)

Gerhard Dehm
Dierk Raabe
Martin Stratmann
Jörg Neugebauer
Kai de Weldige

Structure and Micro/Nano-mechanics of Materials
Microstructure Physics and Alloy Design
Interface Chemistry and Surface Engineering
Computational Materials Design
Administration
MPIE research focus: areas of high expertise

New Materials: Integrated Design, Synthesis

Surfaces and Interfaces: Structure, Stability, Reactions

Microstructure – Property Correlations

Multiscale Simulation and Characterization

Materials: Energy, Transportation, Health, Manufacturing
MPIE research focus: areas of high expertise

![Diagram showing length and time scales with various scientific topics](image-url)
MPIE research focus: areas of high expertise

- Alloys lighter than water
- Boundary conditions
- H-charging effect on TWIP steel
- New turbine

Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany
Answering societies' grand challenges with complex alloys

European Materials and Systems Engineering: knowledge based solutions to grand challenges in: energy, transportation, health, safety, infrastructure
Answering societies' grand challenges with complex alloys

70% of all industrial innovations are associated with progress in materials science and engineering

Complex Materials occupy key roles (energy, transportation, health, safety, infrastructure)

Materials-related industries account for 46% of all EU manufacturing value and 11% of the EU’s total domestic product

3.5 billion € per day in the EU

World Trade Organisation

Our mission: Understanding and designing complex materials and mechanisms for real environments from first principles
MPIE network

RUB: Ruhr University Bochum; RWTH: Aachen University; MMM: Max-Planck Multiscale Modeling Initiative; ICAMS: Inst. For Computational Materials Science at RUB; SURM: Max-Planck Graduate School
MPIE network

RUB - RWTH - MPIE

industry industry industry

DFG: From atoms to turbines (SFB 103); Steel - ab-initio (SFB 761)

University Centers: CES - Center for Electrochemical Sciences; Cluster of Excellence RESOLV; AICES- Aachen Institute for Advanced Study; Graduate School Aachen Institute for Advanced Study in Computational Engineering Science; ICAMS - Simulation Center at RUB

Max-Planck Initiatives: SURMAT Max-Planck Graduate School; Max-Planck Multiscale Modeling Initiative; 2 MPG-FhG groups (simulation, coatings)
MPIE network

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International Max Planck Research School

- Structured PhD programme (since 2004)
- MPIs in Düsseldorf and Mülheim, Ruhr-Universität Bochum, ICAMS
- Interdisciplinary: catalysis, corrosion, interfaces, thin films, alloy design
- Evaluation spring 2014: application for 6 years extension

Since 2004:
- 84 students – 27 countries (1180 applicants)
- 42 PhD – 7 with distinction
- 193 peer reviewed papers
Last board meeting: strengthen synthesis

Making new alloys

Mechanism-driven

Combinatorial

Integrated materials design

Bulk dimensions

Rapid Alloy Prototyping – combinatorial synthesis and processing
Rapid alloy prototyping: combinatorial design of complex alloys

Combinatorial strip casting

RAP: Steel-plant-in-a-box

45 states
135 samples
6 months → 5 days
The Düsseldorf Max-Planck Team

science
idea
...enables progress in complex materials design

technology

Thanks for the attention