

**Introduction to
Nuclear Fusion
(409.308A, 3 Credits)**

Prof. Dr. Yong-Su Na

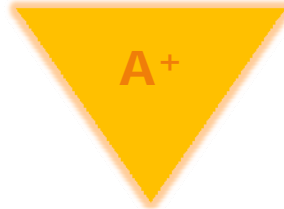
(32-206, Tel. 880-7204)

Why EMC?

- **EMC**
 - EMC is English Mediated Course.
 - English mediates the process between instructional content and student learning.

How to Succeed?

- Golden triangle



- Use NON-colloquial languages
Speak slowly
Don't need to care about your
pronunciation and accent



- Question in Korean



How to Succeed?

- Group/Pair work



- Phone number / e-mail address



How to Succeed?

- One minute paper

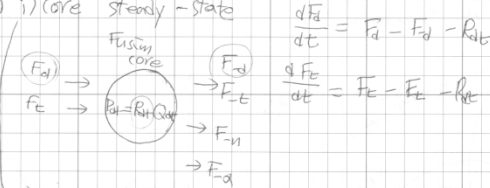
Title 4/7 핵융합공학2 반진우 이윤아 Date

① Nuclear activity

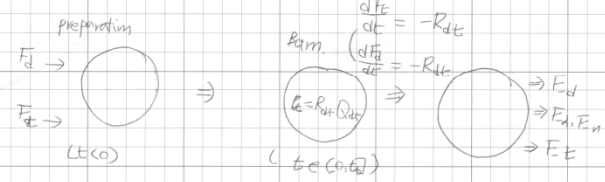
$$\frac{dN^*}{dt} = \lambda_E N^* = \frac{\lambda_E \cdot N_E}{M_E} \approx 10^7 \text{ Ci}$$

$M_E = N_E \cdot M_E$ * license 없을 상태서 Tritium 취급가능; 10^{-3} Ci
 $\therefore 10^7 \text{ Ci}$ 는 license 필요

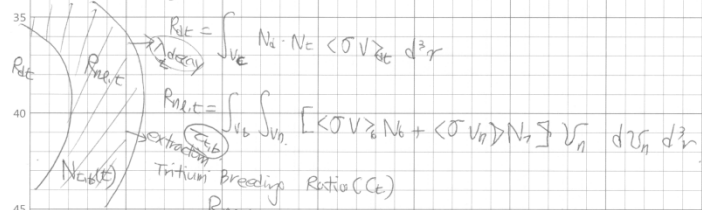
② i) core steady-state



ii) pulsed operation



③ blanket 포함 I



(Loss) $\lambda_{decay} \cdot N_E(t)$
 extraction $\lambda_{extraction}$
 $N_E(t) = (\text{Blanket 생성되는 T}) + (\text{core에서 생산되는 T}) - (\text{decay loss}) - (\text{extraction loss})$
 $\lambda = \text{decay constant}$
 $T_b = \text{equilibrium time}$
 $T_{L, 0.25} = \text{mean residence time}$

Introduction

Text and References:

- A.A. Harms, K.F. Schoepf, G.H. Miley, D.R. Kingdon, "Principles of Fusion Energy", World Scientific Publishing Co. Pte. Ltd. (2000)
- G. McCracken, P. Stott, "Fusion The Energy of the Universe", Elsevier Inc. (2005)
- F.F. Chen, "Introduction to Plasma Physics and Controlled Fusion, Volume 1: Plasma Physics", 2nd Edition, Springer (2006)
- J.A. Bittencourt, "Fundamentals of Plasma Physics", 3rd Edition, Springer (2004)
- B.B. Kadomtsev, "Tokamak Plasma: A Complex Physical System", Institute of Physics Publishing Bristol and Philadelphia (1992)
- R.A. Gross, "Fusion Energy", John-Wiley (1984)
- W.M. Stacey, Jr., "Fusion An Introduction to the Physics and Technology of Magnetic Confinement Fusion", John-Wiley (1984)
- J. Feidberg, "Plasma Physics and Fusion Energy", Cambridge (2007)

Introduction

Evaluation

- Attendance: 10%
- Homework: 10%
- Midterm exam: 30%
- Final exam: 30%
- Project: 20%

Project: To be announced

Contents

Week 1. Fundamentals of Nuclear Fusion I

- Present Status and Future Prospect

Week 2. Fundamentals of Nuclear Fusion II

- Fusion Reactions

Week 3. Fundamentals of Nuclear Fusion III

- Thermonuclear Fusion Conditions

Week 4. Review of Plasma Physics

- Plasma Confinement, Transport,
Equilibrium, and Stability

Week 5. Inertial Confinement

Week 6. Magnetic Confinement

- Mirror, Pinches, and Stellarator

Contents

Week 9. Tokamaks I

- Plasma Equilibrium and Stability

Week 10. Tokamaks II

- Plasma Transport

Week 11. Plasma Heating and Current Drive

- OH, NBI, RF, Adiabatic Compression,
and Alpha Self-heating

Week 12. Plasma Wall Interaction

Week 13. Overview of Fusion Power Plants

Week 14. Critical Issues in Fusion Researches

Contents

Week 1. Fundamentals of Nuclear Fusion I

- Present Status and Future Prospect

Week 2. Fundamentals of Nuclear Fusion II

- Fusion Reactions

Week 3. Fundamentals of Nuclear Fusion III

- Thermonuclear Fusion Conditions

Week 4. Review of Plasma Physics

- Plasma Confinement, Transport, Equilibrium, and Stability

Week 5. Inertial Confinement

Week 6. Magnetic Confinement

- Mirror, Pinches, and Stellarator