Development and application of innovative oxidation reaction control technology using safe oxidizing agents

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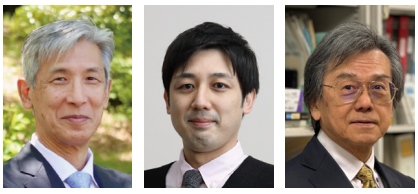


Abstract

Control of chlorine dioxide radical activation from chlorite ions in disinfectants and deodorizers has been achieved through the MA-T (Matching Transformation System) technology. This enabled the development of innovative oxidation methods, including conversion of biomethane gas to liquid and surface oxidation of polymers. It also led to the creation of the Epoxidized Graphene Grid (EG-grid®), which immobilizes native proteins on graphene films for accelerated cryo-EM analysis. Currently, the EG-grid® is being utilized to develop antibody drugs for cancers with high unmet medical needs and to analyze epitope information.

Background & Results

SARS-CoV-2 emerged in Wuhan, China, in December 2019, infecting 770 million people and causing over 7 million deaths (WHO, 2023). Antibodies are typically produced by immunizing rabbits, mice, or alpacas with antigenic proteins, resulting in multiple antibody types. Without epitope information, developing bispecific antibodies with higher binding constants is impossible.

Using the EG-grid® for cryo-electron microscopy, we immobilized a complex of VHH antibodies (P86 and P559) with the spike protein, rapidly obtaining epitope information to develop a bispecific antibody (P559-P86(R45L)). This antibody was effective against SARS-CoV-2 and its BQ1.1 and XBB variants, providing vital guidance for antibody design and therapeutic strategies against novel coronavirus strains (presented at CROI, 2023).

The EG-grid is also anticipated to play a significant role in the rapid analysis of epitope information for antibody drug development in other diseases.

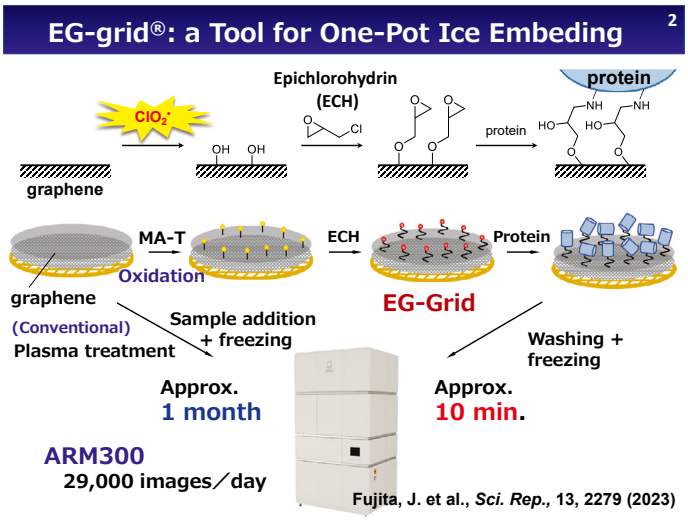
Significance of the research and Future perspective

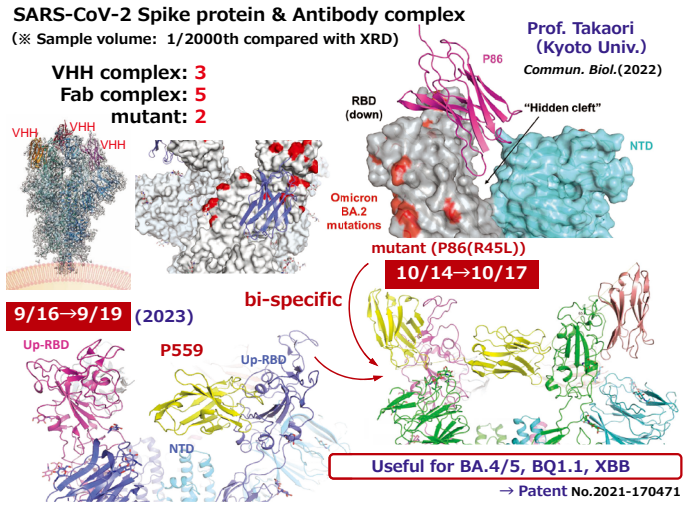
The MA-T technology is being considered for application in many fields, including medicine, environmental protection, development of new chemical reactions and new materials.

Especially significant is the development of a device that accelerates the structural analysis of proteins by cryo-electron microscopy and speeds up the acquisition of epitope information required for antibody drugs.

In the future, it is expected that the rapid analysis of epitope information on antibodies obtained in AI drug discovery, etc., will lead to the development of new antibody drugs for cancers and other diseases with high UMN.

The advancement of this technology is expected to contribute to the creation of new drugs with highly accurate structural information and promote innovation in the medical field.





Patent	PCT/JP2020/014148
Treatise	Fujita, Junso; Makino, Fumiaki; Asahara, Haruyasu et al. Epoxidized graphene grid for highly efficient high-resolution cryoEM structural analysis. Scientific Reports. 2023, 13, 2279. doi: 10.1038/s41598-023-29396-0 Maeda, Ryota; Fujita, Junso; Konishi, Yoshinobu et al. A panel of nanobodies recognizing conserved hidden clefts of all SARS-CoV-2 spike variants including Omicron. Communications Biology. 2022,5, 669. doi: 10.1038/s42003-022-03630-3
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