

EFEK POLARITAS ADITIF PELARUT TERHADAP KESTABILAN FILM TIPIS PEROVSKIT METIL AMMONIUM TIMBAL(II) IODIDA

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INTISARI

Efek polaritas alkohol (2-propanol, 1-butanol, dan 1-propanol) sebagai aditif pelarut pada hasil sintesis dan stabilitas film perovskit metil ammonium timbal(II) iodida ($\text{CH}_3\text{NH}_3\text{PbI}_3$) telah dipelajari. Tujuan penelitian ini untuk mengetahui peranan efek polaritas aditif pelarut terhadap kristalinitas film $\text{Pb}(\text{NO}_3)_2$ sebagai film prekursor, ukuran *grain* film perovskit, dan stabilitas film perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ terhadap paparan kelembapan udara. Preparasi film tipis perovskit dilakukan melalui pembentukan film prekursor $\text{Pb}(\text{NO}_3)_2$ menggunakan metode *spin coating* dengan kecepatan 2500 rpm selama 30 detik dengan bantuan 2-propanol, 1-butanol, atau 1-propanol sebagai aditif pelarut di samping DMSO sebagai pelarut. Film $\text{Pb}(\text{NO}_3)_2$ direndam di dalam larutan $\text{CH}_3\text{NH}_3\text{I}$ selama 30 menit menghasilkan film perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$. Pengaruh polaritas aditif pelarut terhadap kristalinitas film $\text{Pb}(\text{NO}_3)_2$ dan film perovskit dipelajari menggunakan metode difraksi sinar-X. Pengaruh polaritas aditif pelarut terhadap ukuran *grain* perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ dipelajari menggunakan metode mikroskop elektron. Kestabilan film perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ terhadap paparan kelembapan udara relatif 75% dan 33% selama 24 jam dikaji menggunakan metode difraksi sinar-X dan analisis SEM.

Hasil penelitian menunjukkan penurunan kristalinitas film $\text{Pb}(\text{NO}_3)_2$ sejalan dengan meningkatnya polaritas aditif pelarut. Film $\text{Pb}(\text{NO}_3)_2$ dengan kristalinitas rendah menghasilkan film perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ dengan kemurnian tinggi yang ditandai dengan tidak ditemukannya residu $(\text{CH}_3\text{NH}_3)_4\text{PbI}_6 \cdot 2\text{H}_2\text{O}$ serta peningkatan ukuran *grain* hingga mencapai 2,45 μm . Perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ dengan ukuran *grain* 2,45 μm memiliki kestabilan paling baik dengan nilai persentase degradasi sebesar 43,09% pada kelembapan udara relatif 33%. Pada kelembapan udara relatif 75%, ukuran *grain* perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$ tidak memiliki pengaruh signifikan terhadap kestabilan perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$.

Kata kunci: perovskit $\text{CH}_3\text{NH}_3\text{PbI}_3$, aditif pelarut, polaritas, ukuran *grain*, degradasi

EFFECT OF SOLVENT ADDITIVE POLARITY ON STABILITY OF METHYL AMMONIUM LEAD(II) IODIDE PEROVSKITE THIN FILM

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ABSTRACT

Effect of alcohols (2-propanol, 1-butanol and 1-propanol) polarity as a solvent additive in the synthesis product and stability of methyl ammonium lead(II) iodide ($\text{CH}_3\text{NH}_3\text{PbI}_3$) perovskite film has been studied. The aim of this research is to examine the effect of solvent additive polarity on the crystallinity of $\text{Pb}(\text{NO}_3)_2$ as the film's precursor and grain size of the resulted $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film, as well as the stability of the resulted film on humidity exposure. Preparation of perovskite thin film was conducted by formation of $\text{Pb}(\text{NO}_3)_2$ as the film's precursor film by spin coating method at 2500 rpm for 30 seconds with addition of 2-propanol, 1-butanol or 1-propanol as solvent additives in addition of DMSO as the main solvent. $\text{Pb}(\text{NO}_3)_2$ film was immersed in $\text{CH}_3\text{NH}_3\text{I}$ solution for 30 minutes to produce $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film. The effect of solvent additive polarity on the grain size of perovskite film was studied using electron microscope method. Stability of $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film at 75 and 33% relative humidity was studied by using X-ray diffraction and SEM analysis.

The results showed that increasing polarity of the solvent additives resulted in decreasing on the crystallinity of $\text{Pb}(\text{NO}_3)_2$ film. $\text{Pb}(\text{NO}_3)_2$ film with low crystallinity yielded high purity of $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film with no $(\text{CH}_3\text{NH}_3)_4\text{PbI}_6 \cdot 2\text{H}_2\text{O}$ residue and grain size up to $2.45 \mu\text{m}$. $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film with grain size of $2.45 \mu\text{m}$ has good stability at 33% relative humidity with 43.09% degradation percentage. At 75% relative humidity, the grain size of $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film did not have significant effect on the $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite film stability.

Keywords: $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite, solvent additive, polarity, grain size, degradation