実験報告書様式（一般利用課題・成果公開利用）

（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

J-PARC MLF Experimental Report	提出日 Date of Report
課題番号 Project No. 2014A0304 実験課題名 Title of experiment Influence of EML/ETL interface structure on organic light emitting device's lifetime 実験責任者名 Name of principal investigator Go Matsuba 所属 Affiliation Yamagata University	装置責任者 Name of responsible person 装置名 Name of Instrument/（BL No.） BL16 実施日 Date of Experiment

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

The compounds used in this work are shown in Figure 1.
Poly[N,N'-bis(4-butylphenyl)-N,N'-bis(phenyl)-benzidine] (PTPD) was used as a hole-transporting layer. Tris-(2-(4-methylphenyl)pyridine)iridium(III) (Ir(mppy)3) was used as an emitter in the emitting layer. 3,3'-[Bis(9,9'-phenylcarbazol-3-yl)]-benzophenone (BCzBP) (or deuterated BCzBP (BCzBP-d14) to enhance contrast) was used as host materials in the emitting layer. One component in the emitting layer was selectively deuterated. Here, PTPD has much higher Tg (224°C) than BCzBP (119°C) and BCzBP-d14 (120°C).

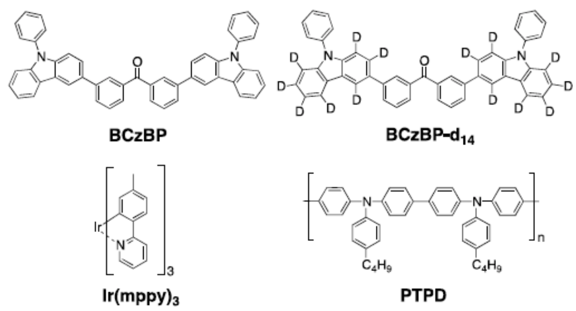

Figure 1. Chemical compounds used in evaluations of interfacial structure.

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

In organic light emitting devices (OLEDs), interfacial structures between multilayers important to improve the OLED characteristics. Herein, we succeeded in revealing the interdiffusion in solution processed and thermal annealed OLEDs by neutron reflectometry (NR).

2. 実験方法及び結果（つづき） Experimental method and results (continued)

We investigated interfaces between a polymer under layer and small molecules upper layer. The small molecules diffused into the swollen polymer layer during the interfacial formation by the solution process, but the polymer did not diffuse into the small molecules layer. Figure 2 shows neutron reflectivity and scattering density profiles of the films

1) BCzBP-d$_{14}$:9wt% Ir(mppy)3 (sEML) was spin coated onto the PTPD spin coated onto a Si wafer and annealed at 135°C for 10 min.

2) BCzBP-d$_{14}$:9wt% Ir(mppy)3 also co-evaporated (eEML) onto the same PTPD film as 1) under vacuum

The 1) films were annealed without annealing (w/o annealing), annealing at 115 °C, 130 °C, and 150 °C.

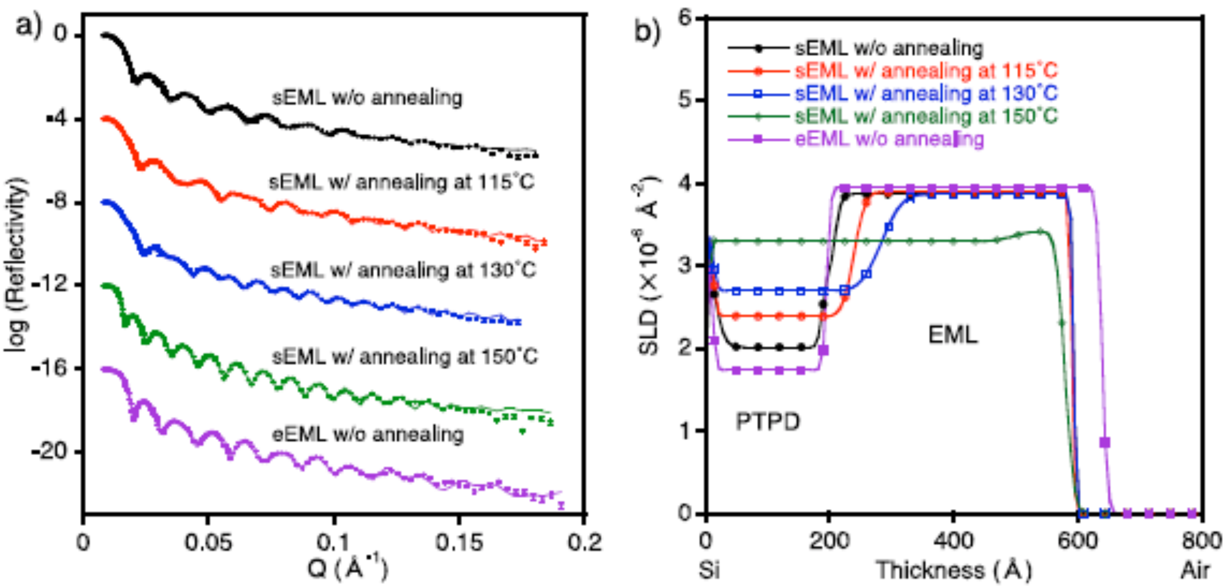

Figure 2. Neutron reflectometry results of PTPD/EML. a) Reflectivity profiles and b) scattering density profiles (SLDs): Si/PTPD/sEML without annealing (closed circles), Si/PTPD/sEML with annealing at 115°C (open circles), 130°C (open squares), 150°C (open diamonds) and Si/PTPD/eEML without annealing (closed squares). The reflectivity scale corresponds to the profile for Si/PTPD/sEML without annealing. For clarity, the other plots are successively offset by subtracting 4. The reflectivity curfve of Si/PTPD/sEML without annealing was fitted with a three-layer model, and the others were fitted with two-layer models. eEML: evaporated BCzBP-d$_{14}$:9wt% Ir(mppy)$_3$ and sEML: spin-coated BCzBP-d$_{14}$:9wt% Ir(mppy)$_3$.

From NR results, at temperatures close to the glass transition temperatures (Tg) of the materials, asymmetric molecular diffusion was observed. We elucidated the effects of the interdiffusion on the characteristics of OLEDs. Partially mixing the interface improved the current efficiencies, due to suppressed triplet-polaron quenching in the interface. Controlling and understanding the interfacial structures of the miultilayers will be more important to improve the OLED characteristics.