

Composite of Cellulose-Nanofiber-Reinforced Cellulose Acetate Butyrate: Improvement of Mechanical Strength by Cross-Linking of Hydroxyl Groups

Romain Milotskyi\*, Ryo Serizawa, Kaoru Yanagisawa, Gyanendra Sharma, Elisabeth Rada Desideria Ito, Tetsuo Fujie, Naoki Wada\*, Kenji Takahashi

Institute of Science and Engineering, Kanazawa University, Kakuma machi, Kanazawa,  
920 1192, Japan

E-mail : romain-mi@se.kanazawa-u.ac.jp ; naoki-wada@se.kanazawa-u.ac.jp

This supplementary material contains:

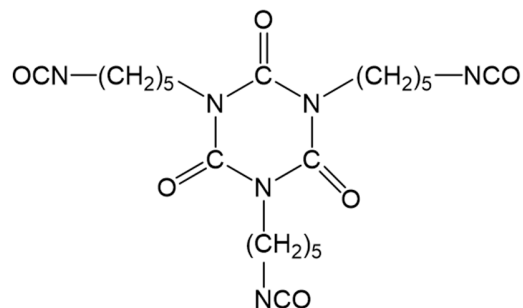
Number of pages: 8

Number of Schemes: 3

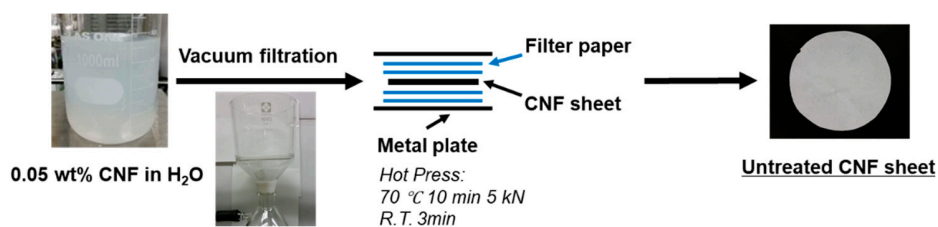
Number of Tables: 2

Number of figures: 8

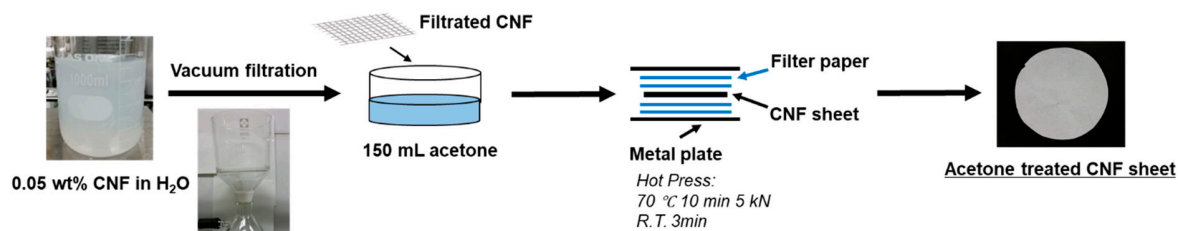
<b>Content</b>	<b>Page #</b>
Scheme S1-S3	2
Table S1-S2	3
Figure S1-S8	4-8



Scheme S1: Crosslinking agent polyisocyanurate D376N (STABio™).



Scheme S2: Detailed preparation of untreated CNF sheet.


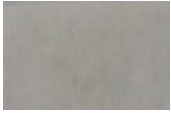
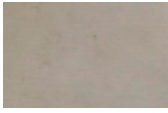



Scheme S3: Detailed preparation of acetone treated CNF sheet (A-CNF).

Table S1: Flow characteristics of CAB500-5.

	$T_s / ^\circ\text{C}$	$T_{fb} / ^\circ\text{C}$	$T_{\text{offset}} / ^\circ\text{C}$	$T_{\text{end}} / ^\circ\text{C}$
CAB500-5	140.2	154.1	173.2	178.4

Table S2: Color of the laminated material for each hot pressing time.

	5 min	15 min	25 min	35 min
Color of laminates				

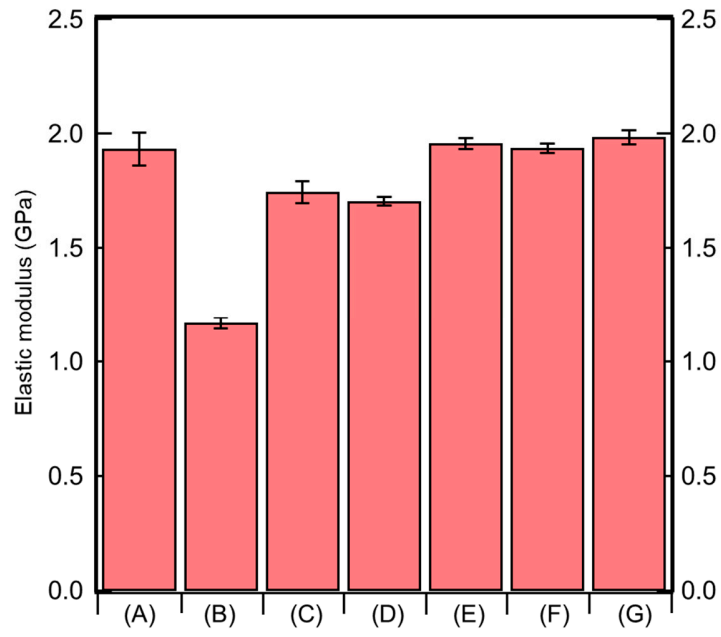


Figure S1: Elastic modulus results of laminated CAB/A-CNF/D376N for different cross linker amounts. Samples: **(A)** A-CNF; **(B)** CAB500-5; **(C)** CAB/A-CNF/D376N (0 wt%); **(D)** CAB/A-CNF/D376N (3.9 wt%); **(E)** CAB/A-CNF/D376N (7.7 wt%); **(F)** CAB/A-CNF/D376N (14.3 wt%); **(G)** CAB/A-CNF/D376N (24.5 wt%).

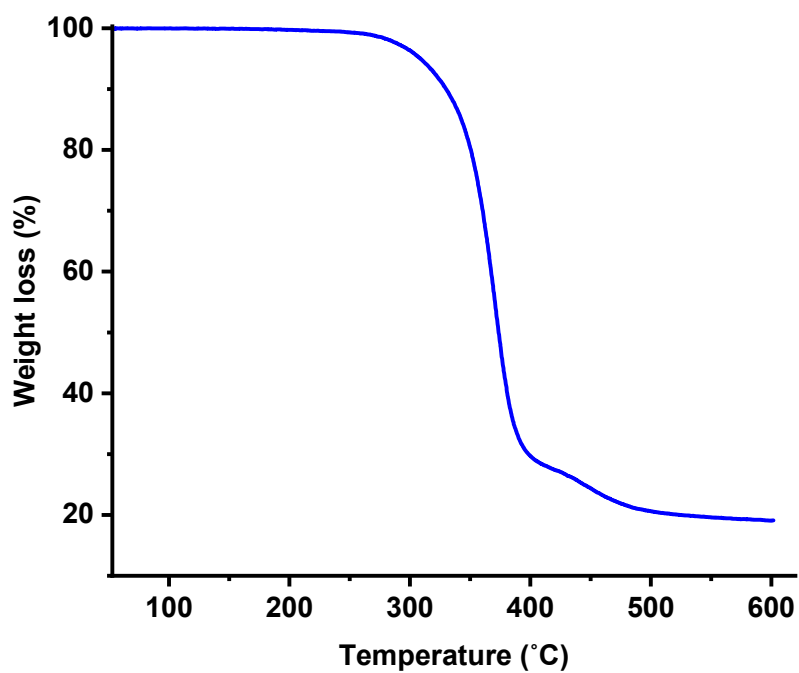


Figure S2: TGA thermogram of CAB/A-CNF/D376N (14.3 wt%)

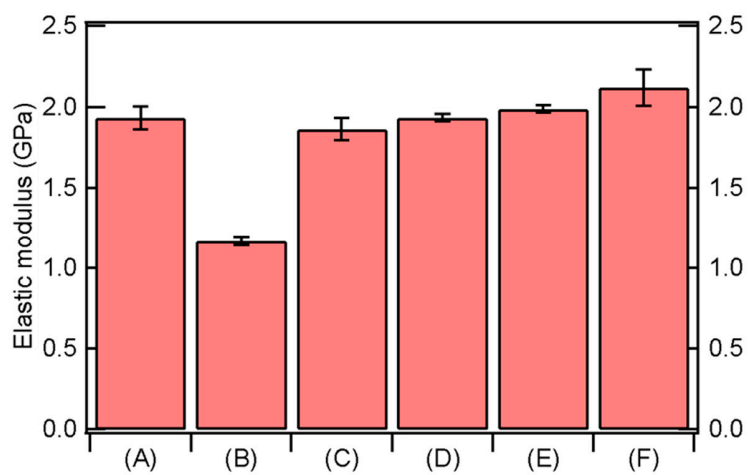


Figure S3: Elastic modulus results of laminated CAB/A-CNF/D376N for different cross linking time. Samples: (A) A-CNF; (B) CAB500-5; (C) CAB/A-CNF/D376N (5 min); (D) CAB/A-CNF/D376N (15 min); (E) CAB/A-CNF/D376N (25 min); (F) CAB/A-CNF/D376N (35 min).

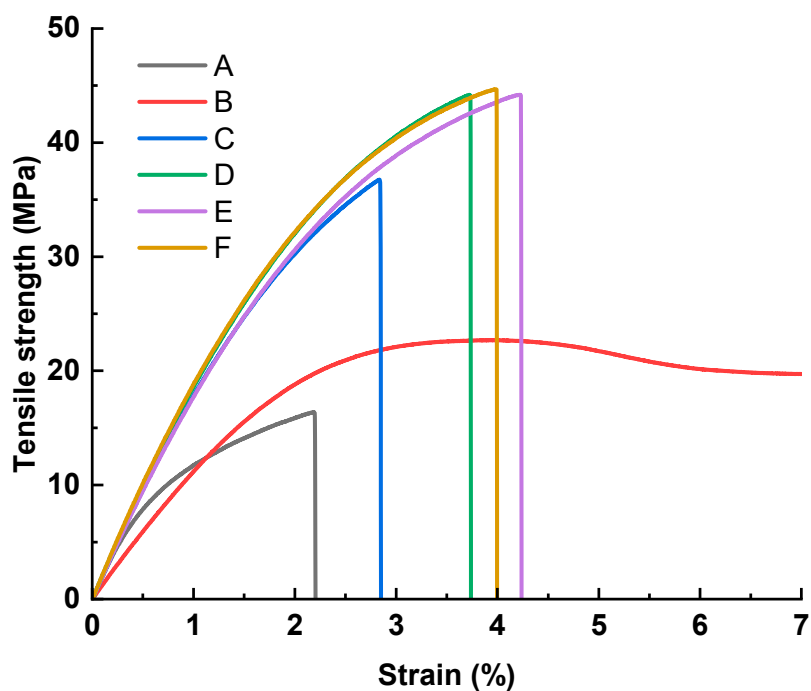


Figure S4: Tensile strength-strain behavior of laminated CAB/A-CNF/D376N for different hot press pressure. Samples: (A) A-CNF; (B) CAB500-5; (C) CAB/A-CNF/D376N 0 kN; (D) CAB/A-CNF/D376N 10 kN; (E) CAB/A-CNF/D376N 20 kN; (F) CAB/A-CNF/D376N 40 kN.

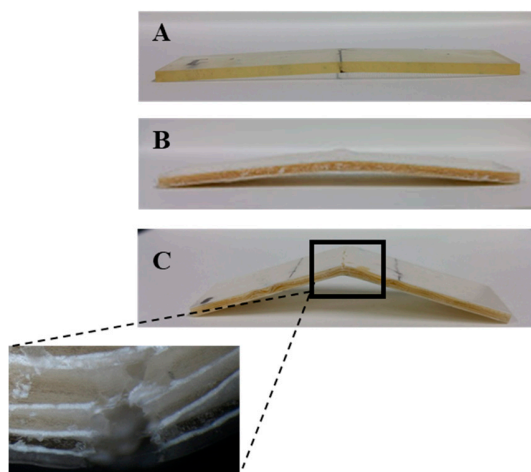


Figure S5: Image of flexural tests results. Samples: (A) CAB; (B) CAB/A-CNF; (C) CAB/A-CNF/D376N (14.3 wt%)

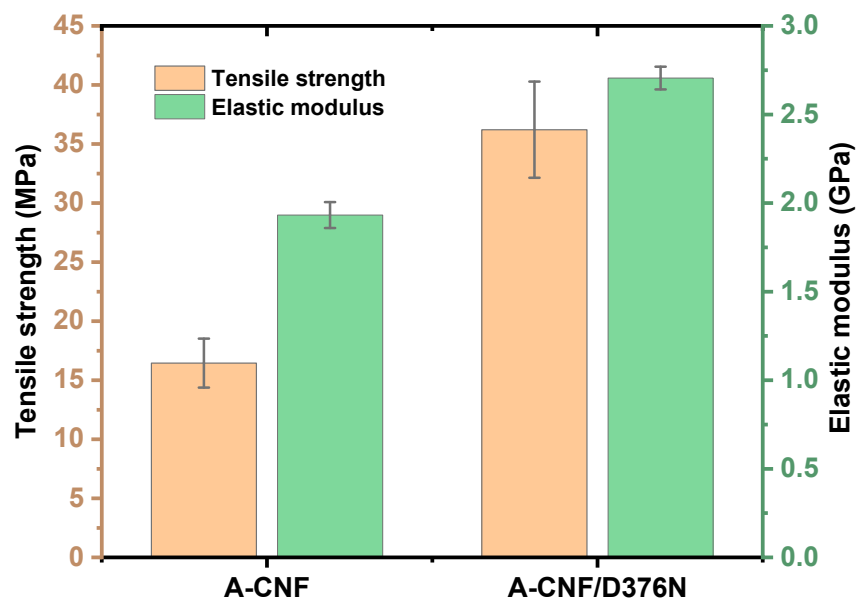


Figure S6: Tensile strength and elastic modulus of A-CNF and A-CNF/D376N

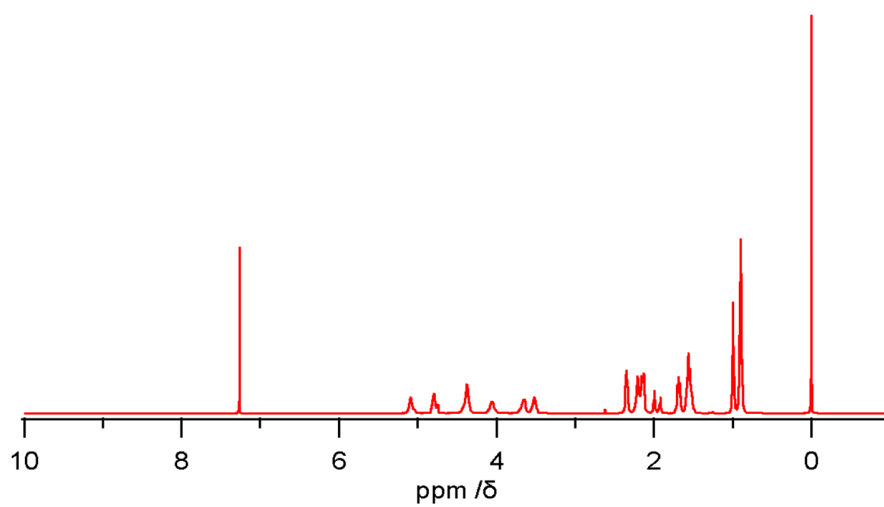


Figure S7: Proton NMR of synthesized CAB500-5 (DS 3).

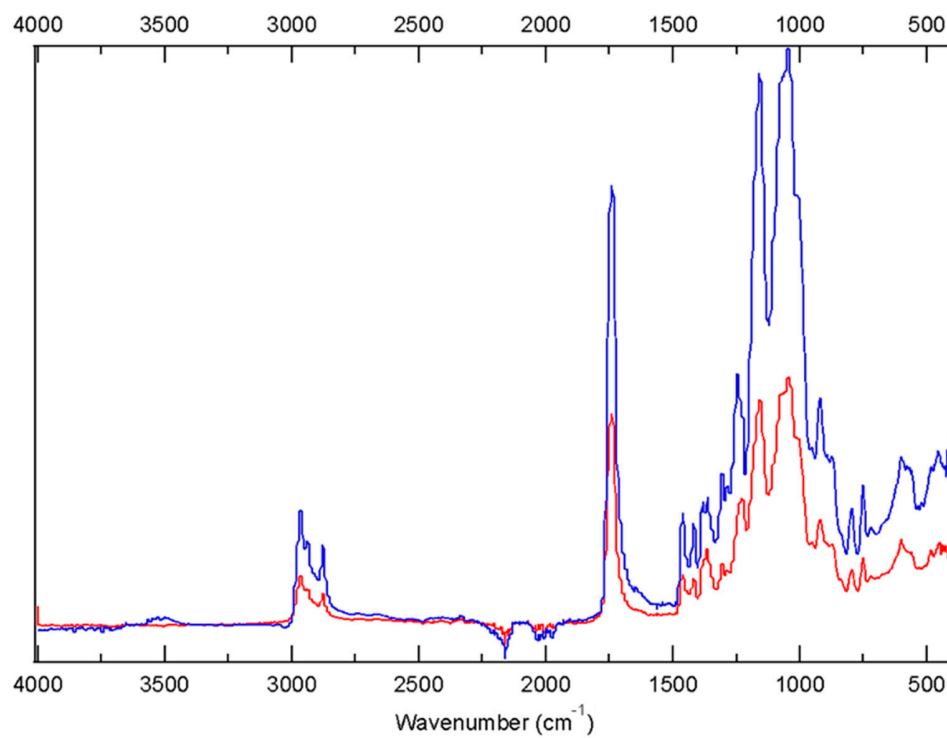


Figure S8: FT-IR spectrum of original CAB500-5 (DS 2.75) (blue) and synthesized CAB500-5 (DS 3) (red).