Supplementary Information:

Stretchable Light-Emitting Electrochemical Cells Fabricated by Spray-Coating

Sandra Gellner[1,2,*], Etienne Auroux[2], Joan Rafols-Ribe[2,3], Nicole Stracke[4], Kumar Saumya[2], Anton Kirch[2], Christian Larsen[2,3], Ekaterina Nannen[1] and Ludvig Edman[2,3,5,*]

[1] Competence Centre for Novel Electronics and Advanced Materials, Faculty of Engineering and Computer Science, University of Applied Sciences Niederrhein, 47805 Krefeld, Germany

[2] The Organic Photonics and Electronics Group, Department of Physics, Umeå University, SE-90187 Umeå, Sweden

[3] LunaLEC AB, Umeå University, SE-90187 Umeå, Sweden

[4] Werkstoffe der Elektrotechnik and CENIDE, University of Duisburg-Essen, 47057 Duisburg, Germany

[5] Wallenberg Initiative Materials Science for Sustainability. Department of Physics, Umeå University, SE-90187 Umeå, Sweden

Table S1. *Summary of key fabrication and performance metrics of stretchable-LECs*

Reference	Fabrication Electrode 1	Fabrication Active material	Fabrication Electrode 2	Initial unstretched performance		Retained relative performance after 20 % stretching	
				Luminance	Current efficacy/ EQE	Luminance	Current efficacy
Yu et al., 2011 [1]	Meyer rod coating (SWNT)	Spin coating	Meyer rod coating (SWNT)	45 cd m^{-2}	0.76 cd A^{-1}	67 %	111 %
Filiatrault et al., 2012 [2]	Vacuum deposition (Au)	Spin coating	Drop casting (EGaIn)		0.1 %	-	-
	Vacuum deposition (Au)	Spin coating	Drop casting (EGaIn)		0.4 %	-	-
Liang et al., 2013 [3]	Meyer rod coating / spray coating (AgNW)	Spin coating	Meyer rod coating / spray coating (AgNW)	135 cd m^{-2}	1.1 cd A^{-1}	122 %	200 %
This work	Spray coating (PEDOT:PSS / AgNW)	Spray coating	Spray coating (PEDOT:PSS)	13 cd m^{-2}	0.73 cd A^{-1}	37 %	133 %
	Spray coating (PEDOT:PSS / AgNW)	Spray coating	Spray coating (PEDOT:PSS)	6.4 cd m^{-2}	0.37 cd A^{-1}	-	-

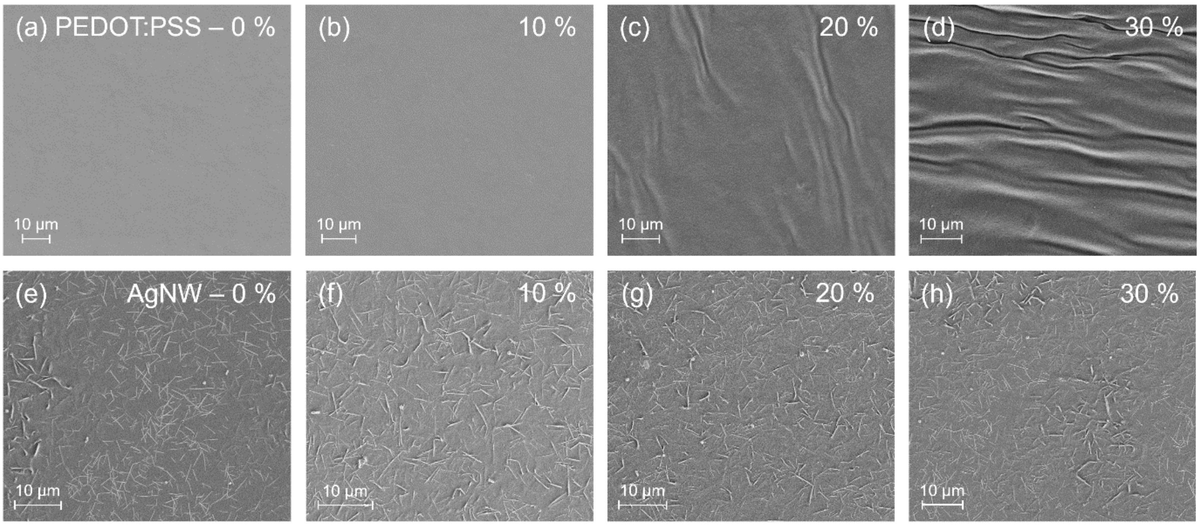

Figure S1. *SEM images of (a - d) PEDOT:PSS films and (e – h) AgNW films following stretching and relaxation. The degree of lateral stretching that the films had been exposed to is detailed in the upper right inset. The films were fabricated by spray-coating on Beyolex substrates.*

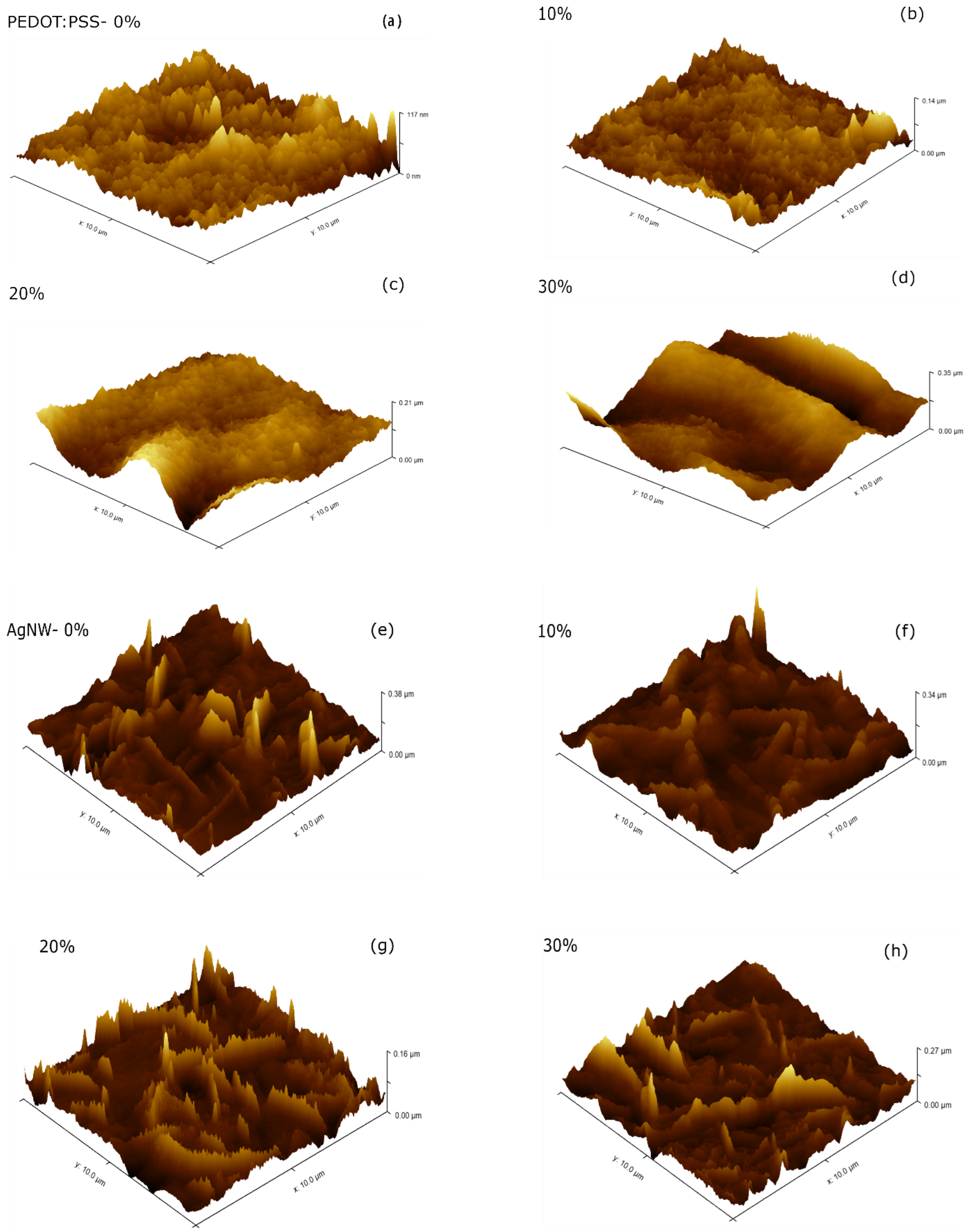

Figure S2. *Topographic images of (a - d) PEDOT:PSS films and (e – h) AgNW films following stretching and relaxation. The degree of lateral stretching that the films had been exposed to is detailed in the upper left inset. Note the differences in the y-axis scale. The films were fabricated by spray-coating on Beyolex substrates.*

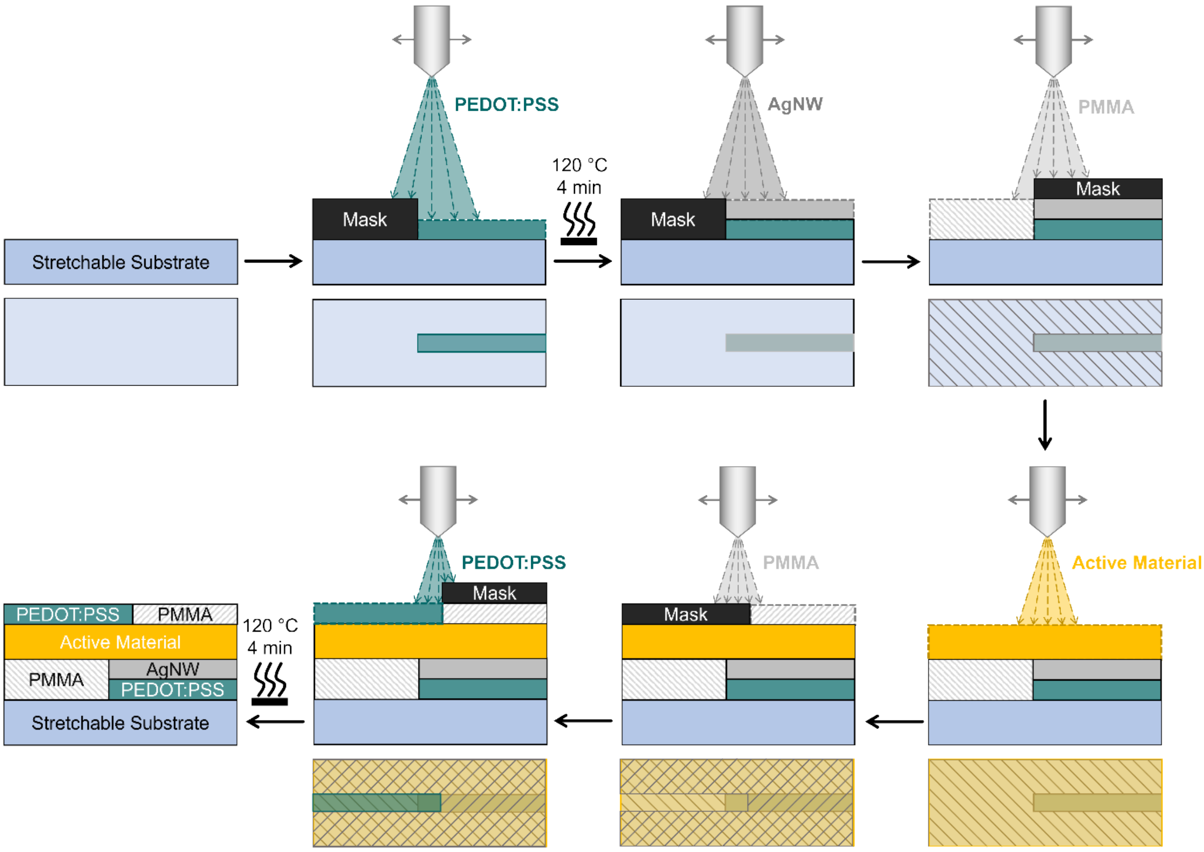

Figure S3. *Schematic of the step-by-step fabrication process of the stretchable LEC, in side-view presentation (upper schematic) and in top-view presentation (lower schematic).*

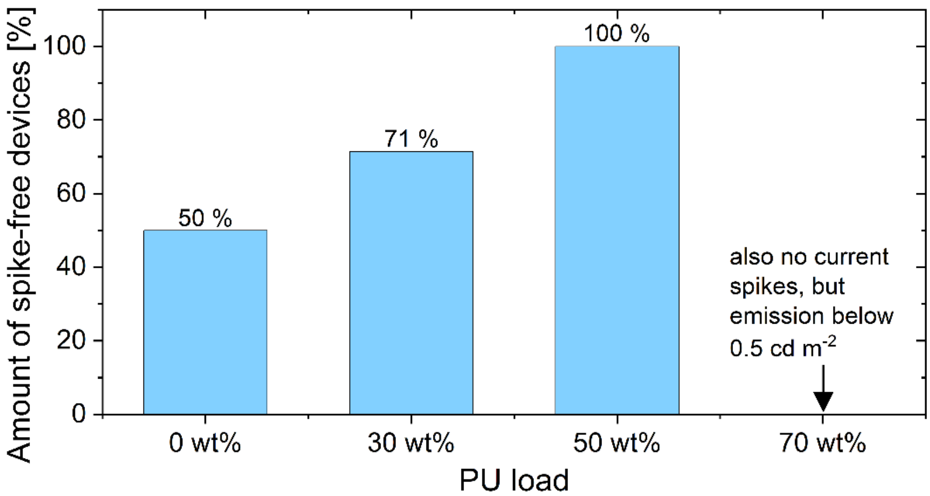

Figure S4. *The percentage of the spray-coated stretchable LECs that did not form high-current "spikes" (and featured significant luminance > 0.5 cd m*$^{-2}$*) as a function of the mass fraction PU in the active material. This statistic is based upon the characterization of more than 20 independent devices.*

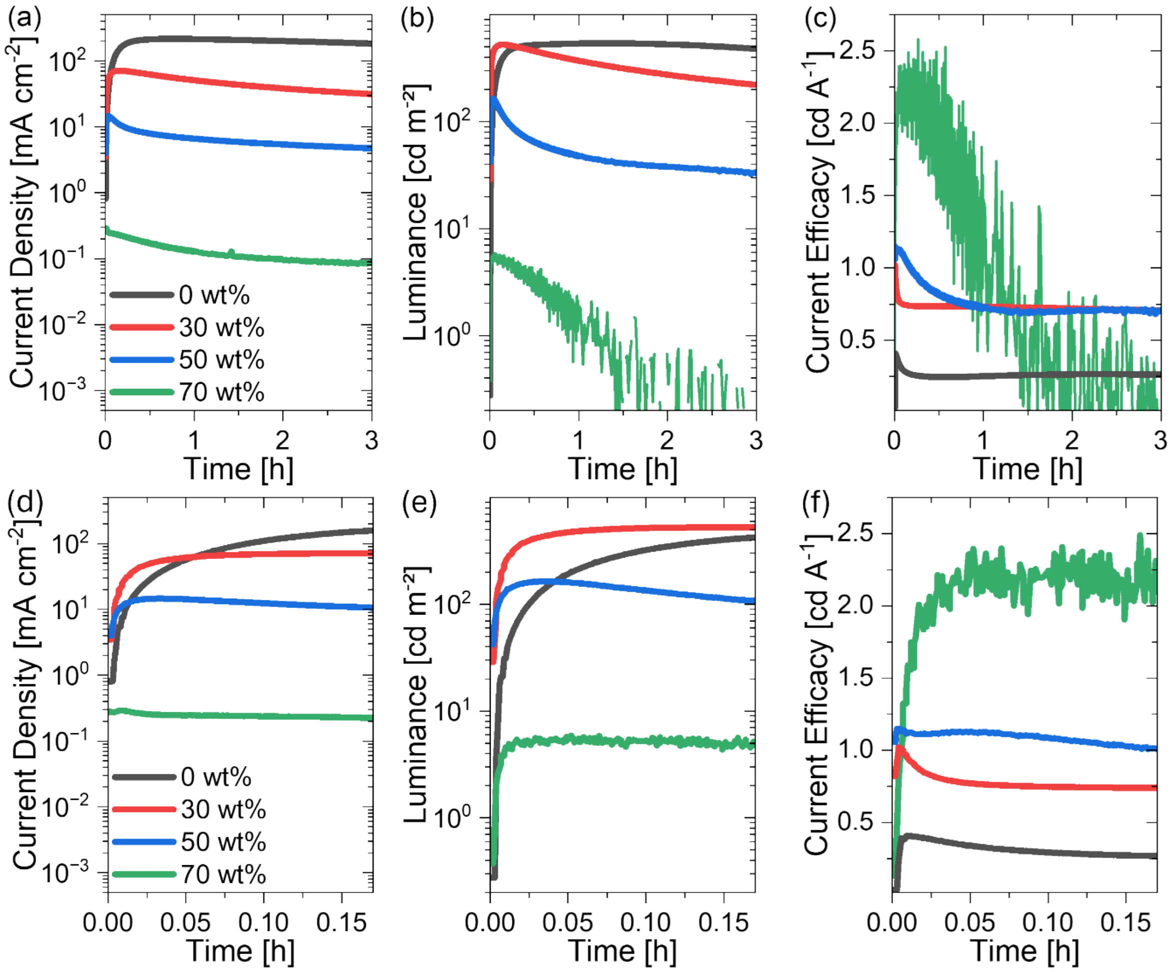

Figure S5. *The transient evolution of (a,d) the current density, (b,e) the luminance and (c,f) the current efficacy of the rigid reference LECs for four different PU concentrations in the active material, as detailed in the inset in (a). (a-c) present the longer-term operation, whereas (d-f) focus in on the turn-on kinetics. The devices were driven by a constant voltage of 4 V.*

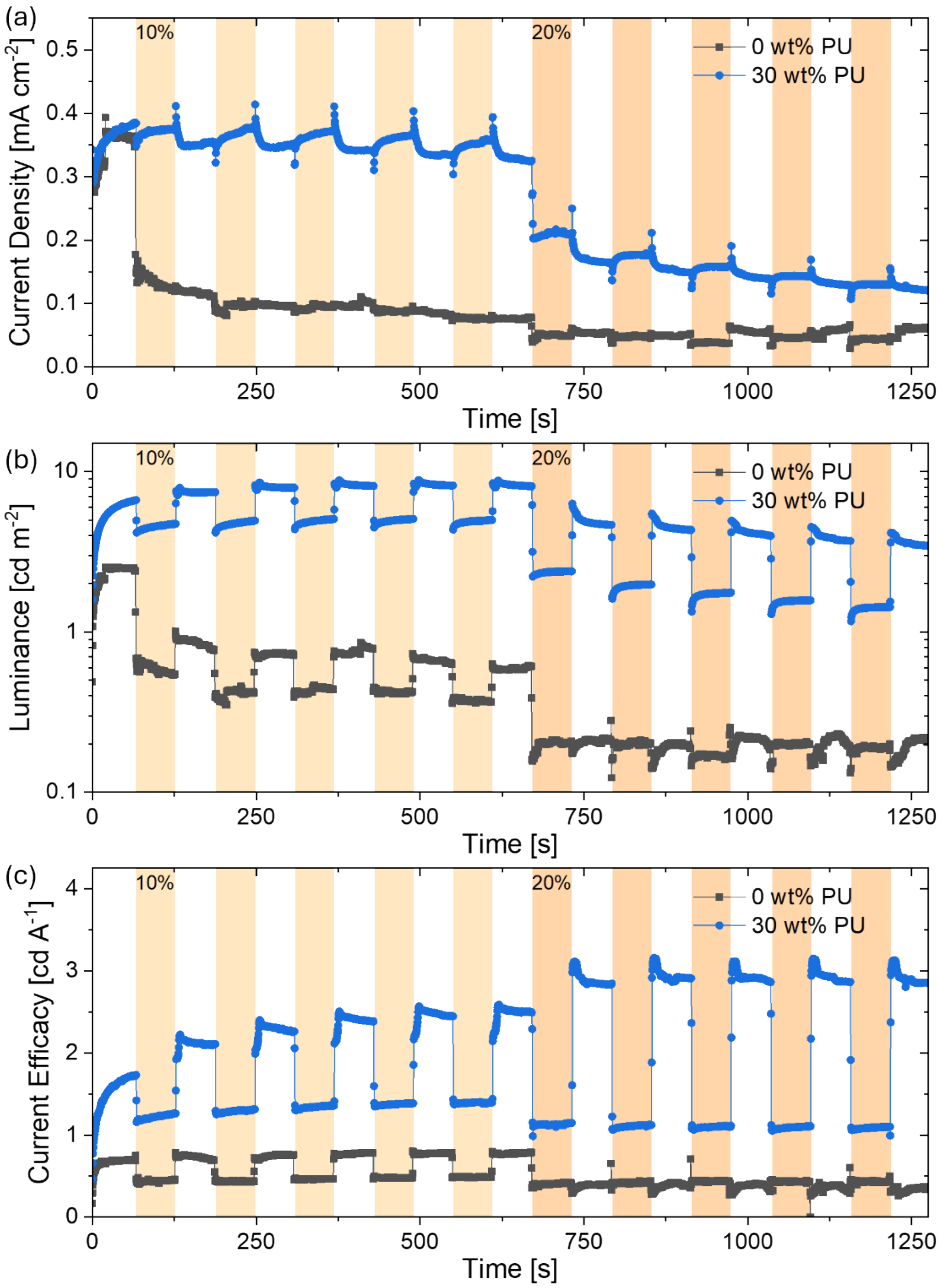

Figure S6. *Comparison of the cycling behavior of the PU-free LEC (grey squares) and the PU-LEC (blue circles) during electrical driving by 40 V. The devices were first cycled five times between 0 and 10 % elongation, and thereafter cycled five times between 0 and 20 % elongation.*

1. Yu, Z., et al., *Intrinsically Stretchable Polymer Light-Emitting Devices Using Carbon Nanotube-Polymer Composite Electrodes.* Advanced Materials, 2011. **23**(34): p. 3989-3994.
2. Filiatrault, H.L., et al., *Stretchable Light-Emitting Electrochemical Cells Using an Elastomeric Emissive Material.* Advanced Materials, 2012. **24**(20): p. 2673-2678.
3. Liang, J., et al., *Elastomeric polymer light-emitting devices and displays.* Nature Photonics, 2013. **7**(10): p. 817-824.

References